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ELECTRICAL REVIEW

25th JULY, 1952

THE OLDEST ELECTRICAL PAPER • ESTABLISHED 1872 • VOL. CLI • NO. 3896

Office Lighting

PROPERTY owners have, through their agents, discovered that daylight has an economic value. They are finding when they build blocks of offices that the upper floors are let first and a consequential tendency is to charge higher rentals for them than tenants are willing to pay for lower floors. Good natural light is one of the factors taken into account by the Ministry of Works when its Lands and Accommodation Department determines rental values. Indeed, so far has this consideration advanced that some owners are becoming content to reduce the total floor area within buildings they propose to erect if by doing so they enable their architects to secure the admission of more daylight.

The desire for better "daylighting" for daytime work and for the provision at other times of artificial light adequate to the task being performed is unquestionably becoming more general. Valuable guidance on the subject with recommendations about means and methods of helping to satisfy this growing desire are contained in the recently issued Post-War Building Study No. 30*. It goes further by emphasizing that artificial light is a far more effective means of improving inadequately daylighted offices than most of the minor expedients often resorted to. Supplementary electric light can, even in new buildings, render acceptable for daytime use many of those internal areas without adequate natural lighting.

The fact that these areas, even in the best of buildings, must always represent a substantial proportion of the whole floor space demonstrates the economic necessity to consider how the use in daytime of appropriate supplementary artificial light will enlarge the depth of zone which can be made to appear well daylighted. If the directly daylighted zone is about 10ft deep, for example, in the view of the authors of this report at least another 10ft could be made to seem well lit; experience may show this figure to be a conservative one. Much clerical and drawing office work should and can, as this report shows, be made easier to see. The intensities

* *Electrical Review*, 27th June, 1952, p. 1404.

of light and levels of illumination recommended in Part III are in accord with those specified in the I.E.S. Code for lighting interiors of buildings, which might almost be named the Weston Code after its principal author. It was endorsed last year by the International Commission on Illumination and the Code now being formulated by the Association Française des Eclairagistes is so similar to the British one as to suggest the eventual possibility of a common basis for the two countries.

EXPORT PRICES

What is the truth about our export prices? Sometimes we are told that British manufacturers are pricing themselves out of overseas markets and yet the Board of Trade figures indicate that export prices have not risen to the same extent as import prices. Professor E. Devons (Manchester University) points out in an article in "Lloyds Bank Review" that products which have a relatively low raw material content (e.g., electrical goods) have risen least in price. He contends that the evidence shows that the export prices of many British products have been kept at an unnecessarily low level. The delicate task of exporters is to earn as much as possible without overstraining the buyers.

POWER CAPACITORS

There is no engineering device that pays for itself so quickly as a capacitor installation for the purpose of reducing the kVA demand upon a power supply network, and it goes on doing so; moreover it is the only means of making sure that plant, cables, transformers and switchgear are used in the most economical manner. Shunt capacitors can also be used for voltage regulation. Series capacitors may be installed to reduce line-voltage drop and to improve load sharing among lines functioning in parallel. Capacitors must be arranged to operate within the limits of their thermal stability, which is governed by their internal temperature rise. Designers must have regard for dielectric loss, heat conductivity and suitable dimensions for cooling. Other economic factors are weight, quality of materials and elimination of void spaces. Dr. R. S. Vincent ended his paper on the subject at the Bournemouth Convention by saying that "the power capacitor, as we know it at present, is on the threshold of revolutionary change." It seems unlikely that changes are as near as that, though they are on the horizon; in these days of shortage of equipment and of fuel it is unwise to delay the extension of power factor correction.

LESS FUEL USED

The generation figures for the first half of the present year, tabulated on another page, show an increase of 1·6 per cent over the corresponding period of 1951. Yet less fuel was used. Coal consumption declined by 3·6 per cent—634,000 tons—and it is reasonable to assume that higher thermal efficiencies were largely responsible for the saving. In the Midlands Division, for instance, it is announced that the increase in the price of coal of 9d a ton has been completely offset by the much higher overall thermal efficiency, which in March reached the record figure of 23·94 per cent.

DIVERSITY

Non-coincidence of consumers' peak demands presents the *prima facie* case for interconnecting the power transmission systems of Great Britain and France, to which the Minister of Fuel and Power referred last week. Diversity in production is also likely to be of eventual importance. France will depend to an increasing extent on water power from the south, which would no doubt give low running costs. The kW capacity, however, would be liable to vary with the seasons and with annual rainfall. The parallel running of thermal and hydro-electric stations ought therefore to benefit both countries.

Catalysts for Oil Refining

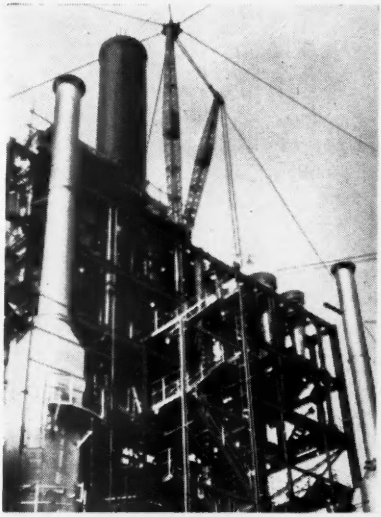
Electrical Installation in a New Plant at Warrington

A PLANT for the manufacture of various types of synthetic fluid catalysts for use in the oil refinery industry has been erected at the Warrington factory of Joseph Crosfield & Sons, Ltd. To cater for the electrical loading of the new plant, with other increased electrical demands of the factory, a new substation was erected between the original main substation of the factory and the adjacent transformer and switching station of the Merseyside and North Wales Electricity Board, No. 2 Sub-Area.

The incoming supply is at 6,000 V, 3 phase, 50 c/s, and a seven-unit Ferguson, Pailin switchboard controls the incoming and outgoing h.v. supplies. A transformer compound is located between the h.v. and l.v. switchhouses. Two Electric Construction Co.'s 1,250 kVA, 6,000/500 V transformers feed into a Johnson & Phillips 28-panel, 500 V switchboard comprising incoming oil circuit breakers, metering panels, bus-section switch and outgoing type SFD air break circuit breakers.

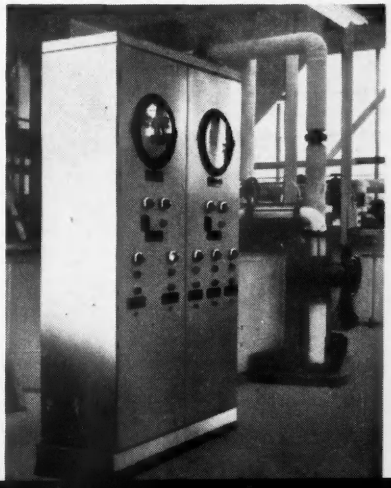
In order to save space in the substation this switchboard was specially designed and placed round three walls of the room. The transformers are each controlled by type L.4 horizontal drawout, industrial ironclad oil circuit breaker units which are A.S.T.A. certified for 37·5 MVA at 600 V. Two metering panels situated one on each side of the incoming units meter the incoming supplies and have a recording power factor meter, a recording wattmeter and a 10-step relay for control of the power factor equipment.

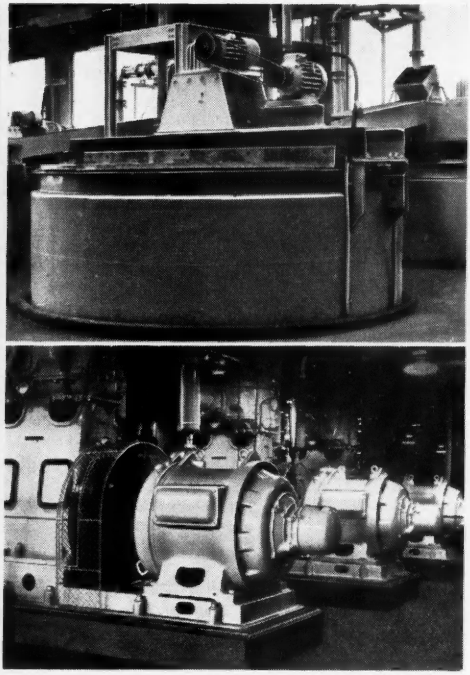
The type SFD automatic air circuit breakers, which control the outgoing feeder circuits, are each fitted with patented 30 MVA rupturing capacity indicating and tripping fuses. Each air circuit breaker is fitted with series connected overload trip coils and adjustable oil dashpot time lags, together with a core balance earth leakage current transformer operating a low wattage earth leakage striker fuse on to the tripping mechanism of the unit, having a fixed setting based on 15 per cent of the primary rating of the core balance current transformers. An air break circuit breaker on each side of the bus-section switch controls



View of spray dryers during construction

Control panel for measuring vessels





Three vacuum pumps and (above) one of the mixing vessels

a contactor switchboard operated from the wattless relays. Capacitors of 50 kVAr rating located on the first floor of the l.v. switchhouse are switched in or out according to the wattless demand of the incoming supply. By locating the supply circuit breaker of the capacitors adjacent to the bus-section switch the benefits of a good power factor, 0·95 lagging, are given to the whole length of the switchboard busbars.

From the l.v. switchboard thirteen 0·3 sq in, 3 core, p.i.l.c. s.w.a. feeders are taken to the adjacent new catalyst plant. Eleven of these feeders terminate at a multi-motor starter switchboard, the other two terminate at fuse switchboards for subdivision to five similar starter switchboards and other services for the building.

The starter switchboards, which were made by Belmos, Ltd., comprise air break contactor switchgear with alternative remote or local control at 110 V. Indicator lamps are fitted either on the boards or at remote stop-start stations for each motor. Sequence interlocking is provided on several elevator and conveyor drives.

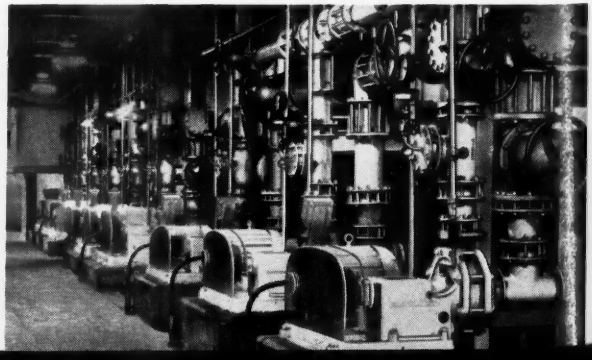
In all 126 500 V, 3 phase, induction type motors totalling 2,228 h.p. are installed, the sizes ranging from $\frac{3}{4}$ h.p. up to 150 h.p. Direct-on-line starting up to 50 h.p. is the general rule with wound rotor or auto-transformer starting on motors above 50 h.p. Motors of 40 h.p. or over are corrected to 0·95 lagging power factor at full load by oil immersed capacitors located adjacent to their switchboards.

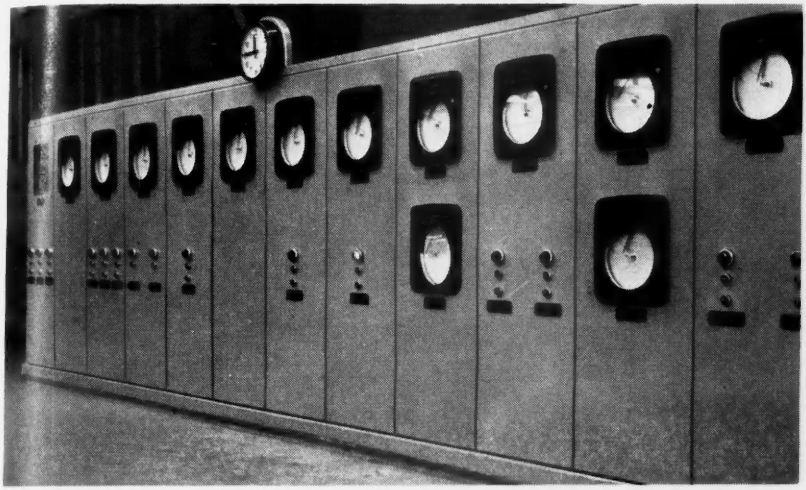
High rupturing capacity cartridge fuses are used throughout the power and lighting installations, including back-up protection on the air break switchgear in the sub-station. All cabling on the ground floor is of lead covered steel wire armoured and served type laid in prepared concrete trenches between starting boards and motors and finally sanded and concrete topped. The edges of the trenches are delineated with a thin compounded line. Cabling to motors and switchboards on the first floor is carried by cable trays suspended from the ground floor ceiling.

Lighting on the first floor, where some degree of colour discrimination is required by process workers, is by means of vapour-proof 5ft single tube daylight fluorescent fittings (Crompton Parkinson) giving a general illumination of 12 ft-candles.

On the ground floor of the main process building and the finished product silos and raw materials buildings lighting to a general illumination of 9 ft-candles is maintained by tungsten-lamp lighting fittings. From

A battery of electrically operated pumps for handling the slurry





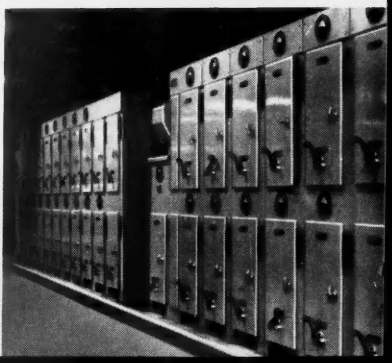
Control panel for mixing operations and (right) section of J. and P. 28-panel totally enclosed l.v. distribution switchboard

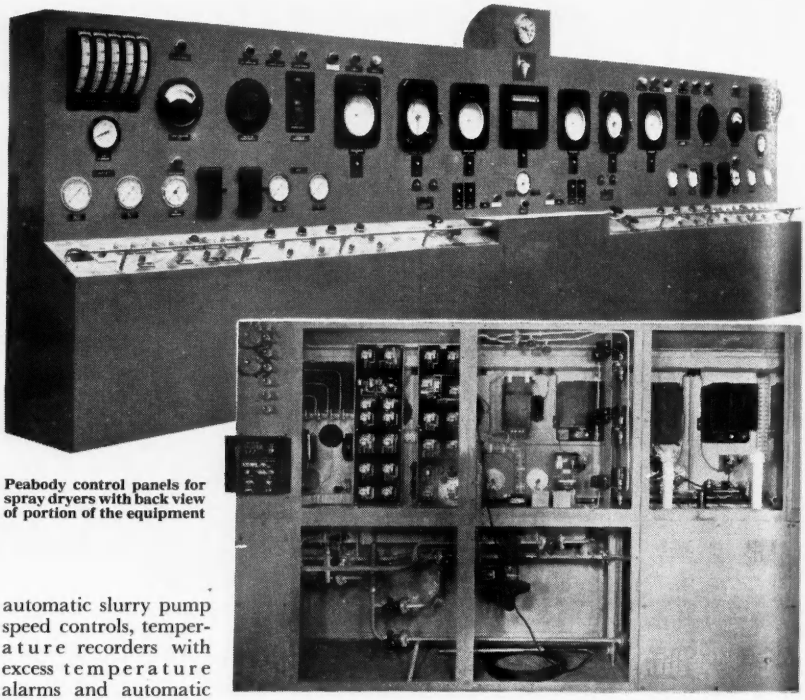
the ceiling of the ground floor much process plant pipework is suspended. Veritys 200 W tungsten-lamp fittings have reflectors arranged to give upward light while preserving the 20 deg cut-off angle for downward directed light. Plug sockets at 50 V are installed for portable inspection lamps.

Automatic control of process liquid temperatures, pH and flow is provided by pneumatically operated controllers and valves. Four process-control panels are located on the first floor and, in addition, floatless electrode type liquid measurement control is used for two vessels.

A twin control panel for the operation of oil fuel fired air heaters on the spray dryers section of the plant was provided by Peabody, Ltd. These panels incorporate

Below: **Belmos switchboards for spray dryer fans and (right) for pumps and air compressors**





Peabody control panels for spray dryers with back view of portion of the equipment

automatic slurry pump speed controls, temperature recorders with excess temperature alarms and automatic damper controls, flame failure oil cut-off controls, smoke density and alarm indicators and push-button controls for air fans, motorized valves and slurry pumps. A single control panel was also provided by Peabody, Ltd., for the control of an oil fired air heater on the flash-dryer section of the plant.

In the analytical and control laboratory of the plant all bench appliances, muffle furnaces, flask heaters, hot plates and general laboratory equipment are made for 110 V single-phase supply. This supply is obtained from a 40 kVA, 500/110 V three-phase transformer with the secondary star point earthed. The 110 V equipment supply is taken from the outers of the secondary and the resultant 63 V phase to earth voltage is designed both to minimize shock risks and decrease insulation earth faults on test equipment.

Apart from the electrical equipment already mentioned the following items were also supplied by the manufacturers indicated:—500 V capacitors, power cables and substation, Johnson & Phillips, Ltd.; power cables for process plant, Crompton Parkinson, Ltd.; fuse-switch gear and distribution fuseboards, English Electric Co., Ltd.; motors, British Thomson-Houston Co., Ltd., English Electric Co., Ltd., Metropolitan-Vickers Electrical Co., Ltd., Lancashire Dynamo & Crypto Co., Ltd., Electric Construction Co., Ltd., and Crompton Parkinson, Ltd.; controllers and instruments, Foxboro-Yoxall, Ltd., Ether, Ltd., Honeywell-Brown, Ltd., George Kent, Ltd., and Short & Mason, Ltd.; and laboratory equipment, J. & W. Towers, Ltd.

Substations and laboratory works were undertaken by Joseph Crosfield & Sons' Engineering Department, the process plant electrical work being carried out by E. B. Badger (Great Britain), Ltd., and J. C. & S. Engineering Department. The process plant installations were carried out by Holiday, Hall & Stinson, Ltd., with site supervision by E. B. Badger (Gt. Britain), Ltd.

Nationalized Industry

Views on Many Aspects

A COLLECTION of essays on many matters relating to nationalized industries which has just appeared* is described by the publishers as " the first serious discussion " of the subject, but the claim is not entirely valid. The Acton Society Trust's series of studies of nationalized industries has already covered much of the same ground in excellent fashion. Nevertheless the present book is a useful addition to the literature of a subject of the greatest moment to modern society.

There are fourteen essays, by well-known authorities, on different aspects of nationalization, including three by the editor himself. In the second part of the book Professor Robson synthesizes the substance of the essays and adds his own views and conclusions. The first essay (by Professor Robson) reviews the course of nationalization in Great Britain; there follow others on compensation (Professor Gilbert Walker and R. H. B. Condie), organization (Austen Albu, M.P.), governing boards (Professor Robson), Ministerial and Parliamentary control (Ernest Davies, M.P.), labour and staff problems (Professor G. D. H. Cole), joint consultation (A. M. F. Palmer), the consumer's interest (Frank Milligan), public relations (Leslie Hardern), price policy (Professor W. Arthur Lewis), efficiency and its measurement (Professor Sargant Florence and Professor Gilbert Walker), scientific research (Edmund Dews), " The Crux of Nationalization " (Sir Arthur Salter, M.P.) and nationalized industries in Britain and France (Professor Robson).

Electricity Supply Position

Most of the references to the electricity supply industry appear to be favourable, although in one respect—joint consultation—the industry, perhaps more than others, is seen to have a too-elaborate organization. As Mr. Palmer puts it, " the sheer weight of the machinery of joint consultation in a nationalized industry may overwhelm and crush its newborn spirit."

Professor Lewis, discussing price policy, agrees with the *Electrical Review*, in contending that unremunerative rural electricity supply should not be subsidized by urban consumers but out of general taxation. The electricity supply industry will agree with Professor Robson that coal, gas and electricity should be given the fullest opportunity to exploit their competitive advantages. In his opinion " any attempt to co-ordinate the supply or prices of gas and electricity should be regarded with great suspicion as a probable plot against the public," although later he says that " the need to conserve our dwindling possible supplies of gas coal may justify discouraging the use of gas for certain purposes."

Principle Accepted

With the exception of Sir Arthur Salter, all the contributors appear to accept the idea of nationalization. Sir Arthur (although not " anti ") thinks that nationalization has been introduced without sufficient forethought of the problems involved and he sees latent evils which must not be allowed to develop. The principal ones are a lack of adequate criteria by which efficiency can be gauged; the ease with which wage increases can be passed on to the consumer; and excessive centralization.

The book can be recommended as a thorough survey of the many facets of the subject, useful to both friends and opponents of nationalization.

* *Problems of Nationalized Industry.* Edited by W. A. Robson. 290 pp. George Allen & Unwin, Ltd., Ruskin House, 40, Museum Street, London, W.C. Price 25s.

Wenvoe Television Station

TEST transmissions on medium power have begun in readiness for the opening of the Wenvoe television station on 15th August. The tests normally take place each week-day between 11 a.m. and noon and between 3 p.m. and 4 p.m.

NEW BOOKS

Modern Lighting Technique. By H. Hewitt, A.M.I.E.E. Pp. 215 + viii; figs. 89; index. Edward Arnold & Co., 41, Maddox Street, London, W.1. Price 21s.

Although the author might, perhaps, have chosen a somewhat less ambitious title for this book, it should prove of considerable value to the student of illuminating engineering, as it covers very fully certain parts of the syllabus for the City and Guilds intermediate examination. In particular, electric lamps, lighting fittings and street lighting are treated at unusual length for a book of this size; the chapters on lamps, for example, together occupy no fewer than 64 pages. There is a good section on practical illuminating engineering and the appendices contain the I.E.S. recommended values of illumination and the tables needed for calculating illumination by the lumen method.

There are few criticisms, but it is a pity that the now generally used symbols *cd* and *lm* for candela and lumen respectively have not been adopted; the reiterated use of $1/ft^2$ for illumination is particularly unfortunate. It is to be hoped that students will not be misled by the statement that "The *average* brightness of a surface which emits or reflects one lumen per square foot is one foot-lambert," and in the diagram of the Macbeth illuminometer the fixed diffuser forming the comparison surface has been omitted. The production of the book is excellent and the diagrams are well set out and clear.—J.W.T.W.

Small Commutator Motors. By K. C. Graham. Pp. 283; figs. and index. Technical Press, Ltd., Gloucester Road, Kingston Hill, Surrey. Price 40s in United Kingdom.

This is essentially a practical, non-mathematical book dealing with d.c., universal and repulsion types of motors. It is suitable for persons having practically no previous knowledge of electrical matters since the subject is treated gradually from first principles, starting with the principles of magnetism, electromagnetism, induction and motors of various designs; all of which are clearly explained and profusely illustrated by diagrams. The author is to be congratulated on the clarity of the diagrams, especially those showing the directions of e.m.f.s in armature windings. Less common types of motors, such as compensated and electrically-reversible commutator motors and governor-controlled series motors, are included in the explanations, but polyphase commutator motors are outside the scope of the work.

Detailed information is given for winding motors, testing and fault location, charts being included to simplify diagnosis of troubles. Mechanical parts of motors, such as bearings, short-circuiting gear, thermal protective devices, etc., are covered. The questions and answers section at the end of each chapter will help the serious reader to retain the essential information. American wire gauges are used in a few charts and no attempt has been made to show the reader how to design windings for a motor. It is suggested that a few pages could have been profitably devoted to periodical inspection and maintenance as well as fault diagnosis and repairs. The book should be useful to students, winders and to service men generally.—J.L.W.

Electrical Development in New Zealand. By H. J. Beeche. Pp. 342. Electrical Supply Authorities' Association of New Zealand, 154, Featherston Street, Wellington, N.Z. Price 30s.

A fairly large part of this book consists of statistical data and history of the individual electric power boards and other bodies which will be of assistance to students of electricity supply. In the narrative portion, which is written in an easy style, the author—for many years secretary and treasurer of the Central Waikato E.P.B.—introduces a number of entertaining asides. As an example, when a butcher complained of the varying rates charged for electricity supplied it was pointed out that the main reason was to enable electricity to be used over as many hours of the day as possible. "Similarly, in the case of the bullock or sheep, the prices fixed for the various joints and cuts are such as to enable the butcher to dispose of the whole carcase."

The regulations governing electricity supply and distribution and the operation of the Electrical Wiremen's Registration Act, 1925, are other subjects of interest to people in this country. The last section of the book covers the activities of the State Hydro-Electric Department.—H.W.

MAGNESTATS and their applications

Typical Circuit Arrangements and Means of Control

By R. D. PETTIT, B.Sc.(Eng.), A.M.I.E.E.*

THE magnestat is a static amplifier comprising saturable reactor and rectifier elements; in other words, a magnetic amplifier. The name "magnestat" has been coined because it aptly implies the dependence of operation upon magnetic phenomena, while stressing the essentially static nature of the amplifier.

A typical magnestat circuit (Fig. 1) consists of two saturable reactors and four rectifying elements. The latter are arranged to form a single-phase bridge with the addition of reactors in two arms. The reactors have control windings A_{11} A_{12}, A_{21} A_{22} and main windings T_{11} T_{12}, T_{21} T_{22} which function to provide a gating action in the application of voltage to the load and, by this means, they exercise control of the rectified output. The output voltage is a function of the reactor core polarization which is sustained by d.c. flowing in control windings A_{11} A_{12} and A_{21} A_{22}. The relationship between control current and output voltage is shown in Fig. 6. The magnestat is an amplifier because a large output power is controlled by a small d.c. signal in the control windings.

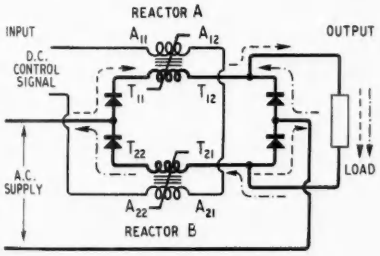


Fig. 1.—Typical magnestat circuit

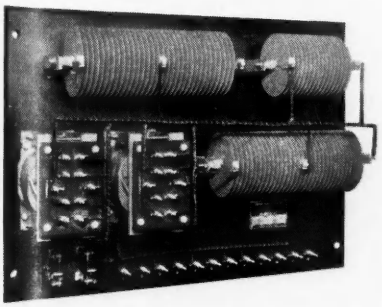


Fig. 2.—A 350 W magnestat, input supply 240 V 50 c/s, output 3·5 A d.c. at 100 V

The example illustrated (Fig. 2) operates from a 240 V 50 c/s input supply and it has a continuous output rating of 350 W at 100 V. The output voltage can be controlled over a range of more than 20 : 1 by a control signal of about 300 mW when the control circuit time constant is 0·2 second.

To simplify description of the mode of operation with the aid of the diagrams (Figs. 3 and 4) a first assumption is made that the B-H curve for the reactor cores is not a practical loop (Fig. 5) but a curve having no breadth, a constant permeability and sharp transition into complete saturation.

The flux in the reactor cores passes through four distinct phases during the course of a complete cycle of the a.c. supply. Assume that, at the start of a cycle, core A has a flux corresponding to the polarizing signal H_0, the position on the B-H curve and in the voltage cycle being indicated by point 1. At first, the supply voltage is supported by the high inductance of the reactor winding, with the core flux changing with the time integral of the voltage. Saturation of core A is

* Electronics Engineering Department, British Thomson-Houston Co., Ltd.

attained at point 2. The inductance of the winding collapses at this instant and, neglecting the resistance of the reactor winding and the forward resistance of the rectifiers, the supply voltage is applied to the load from point 2 until the end of the half-cycle at point 4. It is seen that core A passes through a flux build-up phase and a flux saturation phase in the first half-cycle. Two further phases occur in the following half-cycle and they constitute a flux reset phase and an idle phase.

The means by which the flux is reset depends upon the impedance of the source of the control signal. Extreme conditions are encountered when the control source has either a zero impedance or an infinite impedance. In the case of a zero impedance control source, reactors A and B are coupled by connection of their control windings and, for instance, voltage appearing across the main winding of reactor B is applied by transformer action to reactor A. Hence the voltage appearing across reactor B during its build-up phase is applied through the control

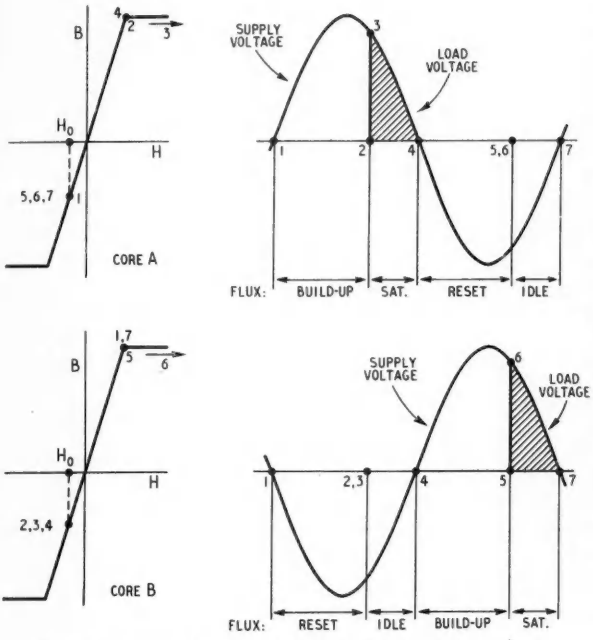


Fig. 3.—Diagrammatic representation of the four states of reactor flux

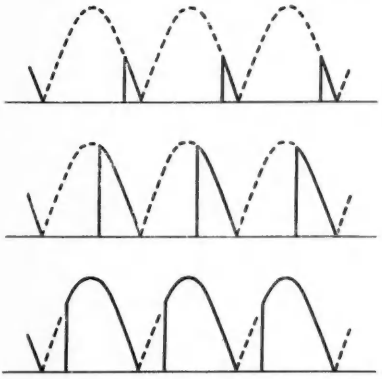


Fig. 4.—Waveforms of output voltages for three different control currents

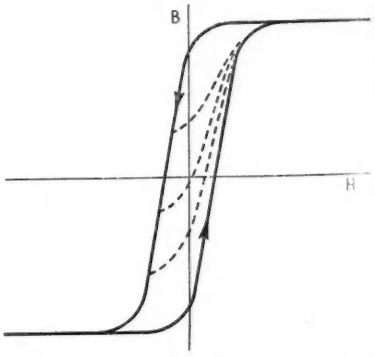


Fig. 5.—Dynamic hysteresis loop for reactor core

circuit to reactor A to reset the flux in this reactor. During the phases in which flux change occurs the core magnetization current flows in the main windings as permitted by the presence of the rectifiers.

A different means of resetting the flux is observed when the control source is of infinite impedance. In this case there is no transformer coupling between the reactor cores. However, core A will unsaturate at point 4 with a small load current flowing in its main winding. This current tends to linger, since the winding is now highly inductive; in fact, even with the assistance of the negative supply voltage, the current remains until point 5 by which time the flux in core A is reset to its start point. The coincidence of points 1 and 5 on the B-H curve is assured by the premise that in an a.c. circuit all steady-state phenomena must recur at intervals of one cycle.

An essential feature of this type of magnestat is the prohibition, by the rectifiers, of current flow in the main winding of the unsaturated reactor during the idle flux phase when the other reactor is conducting current. Any flow of current in the main winding of the unsaturated reactor during this phase must be countered by a positive control current so as to maintain an ampere-turn balance on the unsaturated core. Hence, for instance, rectifier leakage will cause a degeneration of amplifier sensitivity. This means that rectifier leakage should be avoided and, as a practical consideration, it is usually desirable to de-rate the working voltage of the rectifiers to minimize the influence of leakage. If the main windings are reconnected without rectifiers in series the load current will vary in direct proportion to the control current. This type of amplifier is frequently regarded as the basic amplifier, with the amplifier employing series rectifiers designated as a self-excited amplifier.

The mode of operation described with the aid of the idealized B-H curve is modified for a practical amplifier. The core will have a B-H loop similar to that shown in Fig. 5 and the core flux will follow the dynamic minor loops as indicated for various polarizing signals. No attempt is made to offer a complete description of the practical amplifier.

It should be appreciated that the load voltage is a succession of chopped sine-waves. The diagrams in Fig. 4 indicate the load voltage waveforms for three different outputs; it is assumed that the reactor magnetization current is negligible. A similarity between this voltage waveform and that obtained from a bi-phase thyratron rectifier will be noticed.

In the control characteristic of a practical amplifier (using the circuit of Fig. 1) shown in Fig. 6, the reflection of the shape of the B-H curve is particularly noticeable for outputs approaching the maximum. Maximum voltage output is attained with the reactors in a state of complete saturation and with positive control current. The minimum current, corresponding to the magnetization current of the completely unsaturated reactors, is attained with a negative control current. A slightly rising output is obtained with more negative control currents. The control current required to vary the output voltage from the minimum to the maximum is obviously related to the magnitude of the polarizing signal H_0 required to take point 1 from saturation in one direction to saturation in the other direction on the B-H curve. In other words, the property of the core material is the major factor influencing the scale attached to the control current axis of Fig. 6.

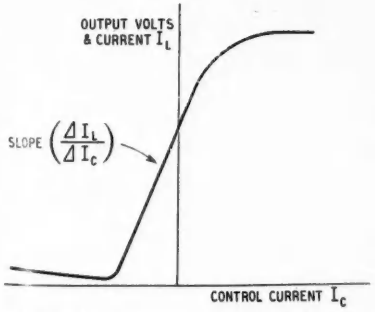


Fig. 6.—Magnestat control characteristic curve

The power gain of the amplifier is obtained from the control characteristic. It can be expressed as $\left[\frac{\Delta I_L}{\Delta I_c}\right]^2 \cdot \frac{R_L}{R_c}$ where R_L is the resistance of the load circuit, R_c is the resistance of the control circuit and $\left[\frac{\Delta I_L}{\Delta I_c}\right]$ is the slope of the curve.

The control current I_c is d.c. flowing in a circuit containing high inductance and, therefore, a time delay exists between the application of a voltage change to the control windings and a resultant change in the output voltage of the amplifier. This delay may be expressed as a time constant which is substantially constant over the linear working range of the amplifier and approximately equal to the L_c/R_c of the control circuit.

The relationship between power gain and time constant is of some practical importance. The expression $\left[\frac{\Delta I_L}{\Delta I_c}\right]^2 . \frac{R_L}{L_c}$, obtained by dividing power gain by time constant, can be called the power gain per unit time constant of the amplifier. It can be regarded as a figure of merit for the amplifier, since usually the ambition in designing an amplifier is to obtain the greatest power gain with the least inherent delay. In this expression the control signal I_c and the control circuit inductance L_c will both vary in proportion to the reciprocal of core permeability and, also, in proportion to the length of the magnetic path. This means that the power gain per unit time constant is increased by increasing the permeability of the core material or by reducing the magnetic path length, that is, core size.

Emerging from this argument is the important fact that not only should the reactor cores have a high permeability but the reactors should be designed to utilize the minimum core material, which is also an economic advantage. A limit to the smallness of the core is set by the permissible temperature rise of the windings.

Another interesting aspect is the influence of the a.c. supply frequency on the power gain per unit time constant of the amplifier. When the a.c. voltage is varied in proportion to the frequency, the working flux in the cores will be maintained at similar values. This means that, for a given magnestat, the supply voltage can be increased in proportion to its frequency and, hence, the output voltage and power gain rise with increase in input supply frequency provided that the a.c. voltage is adjusted in proportion. A limit to the increase of frequency is reached when the loss in the core material becomes excessive.

Nickel-iron materials, such as "Mumetal" and "HCR," are suitable core substances for amplifiers of small power output. For

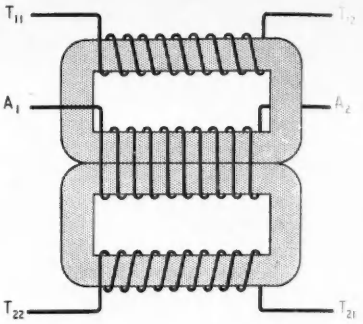


Fig. 7.—Reactor construction with common control winding

outputs above about 10 W with 50 c/s input, advantage is gained by using grain-oriented silicon steel because of its higher saturation flux density and its lower relative cost. The core construction can take the form of: (*a*) overlapping laminations of E or U shape, (*b*) "C" cores of oriented silicon steel, (*c*) uncut laminated cores, or (*d*) strip-wound ring cores over which the coils are toroidally wound. The last-mentioned is undoubtedly the best construction for small power amplifiers using delicate nickel-iron cores.

The use of two separate reactor units as indicated in Fig. 1 can be undesirable if the turns ratio between the main winding and the control winding is high since, in this case, undesirably high a.c. voltages will be induced across the control windings. An alternative arrangement with a common control winding embracing both cores (Fig. 7) overcomes the objection to high a.c. voltages and it also saves copper in the control winding.

The reactors and rectifiers of the magnestat may be readily sealed, either individually or as a whole, within oil-filled containers if the conditions of operation warrant such an action. Circumstances in which sealing is desirable are polluted industrial atmospheres and extreme tropical climates.

The magnestat is inherently reliable. It does not have any components normally regarded as being fragile and there are no moving parts requiring routine maintenance. Its robustness makes it well suited to industrial applications and for use in all types of transportable equipment. The magnestat offers the following advantages

over the electronic valve amplifier: (1) robustness of construction, (2) no heating-up time, (3) electrical isolation of input and output circuits and (4) control circuit of low resistance and working voltage.

The absence of any heating-up time permits immediate operation. The use of control circuits of low resistance and working voltage make it less affected by adverse climatic conditions than the high impedance networks of a valve amplifier. On the other hand the low resistance of magnestat control circuits becomes a disadvantage when means are sought of stabilizing automatic control systems. In this respect the presence of a time constant also creates a disadvantage, but the time constant can be minimized by the choice of a high input supply frequency and, when a high power gain is required, by placing several stages of amplification in cascade.

In comparison with a rotating amplifier, such as an amplidyne, the magnestat gains the advantage of requiring no routine maintenance. However, the output of a magnestat is of one polarity only, whereas a rotating amplifier can have a reversible polarity output. A magnestat circuit to provide a reversing output is relatively inefficient since two magnestats, each supplying a balancing resistor, are required and the power supplied to the balancing resistors is many times the output power. Nevertheless, a reversible output magnestat circuit is practicable provided this loss can be tolerated.

It is possible to use a magnestat in almost any application where either a valve amplifier or a rotating amplifier is usable. Whether or not it is economic or desirable to do so naturally depends upon the circumstances of the application. The following is a short list of applications for which magnestats can be usefully employed: voltage, current and power factor regulators; speed and frequency regulators; servo amplifiers; automatic battery charger controls; sensitive control relays and instrument amplifiers.

Two particular applications of magnestat control will now be described to indicate its usefulness in industrial control systems. The first relates to control of a 350 h.p. motor (Fig. 8) in which the armature derives its input from a polyphase ignitron rectifier with magnestat control and the motor field is energized directly from a magnestat. A simplified diagram of the control scheme (Fig. 9) shows speed regulation to be in two parts: from standstill to base speed control is exercised on armature voltage and upward from base speed on the motor field voltage.

When the speed control potentiometer is set to below base speed, the difference between the reference voltage E_{R1} and the motor armature voltage E_A constitutes an error signal which is applied to the first amplifier stage; this stage uses an electronic valve. The amplified error signal is passed to the control circuit of a magnestat and, from thence, to the saturable reactor phase-shift control and igniter firing circuit of the polyphase rectifier. In this way the amplified error signal is used to correct the error and maintain motor speed. The IR drop compensation and armature current limit circuits, which are included, are not shown on the simplified diagram for the sake of clarity.

Above base speed the field voltage is weakened. The control then is strictly that of field voltage and only indirectly of motor speed. The difference between the reference voltage E_{R2} and the motor field voltage E_F is applied to a two-stage magnestat, the output of which supplies the motor field.

In the photograph (Fig. 8) the armature and field control circuits are in the left-hand side cubicle; the motorized speed control potentiometer is on the lower sub-panel, the electronic and magnestat amplifiers in the armature control circuit are on the sub-panel above this and the first stage

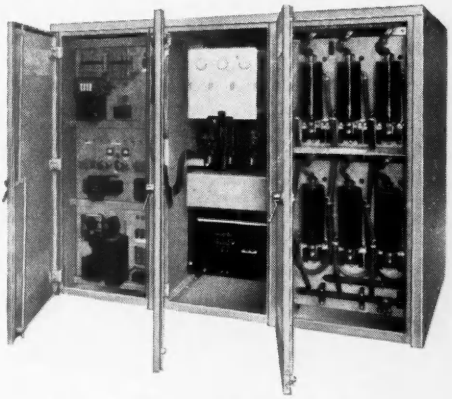
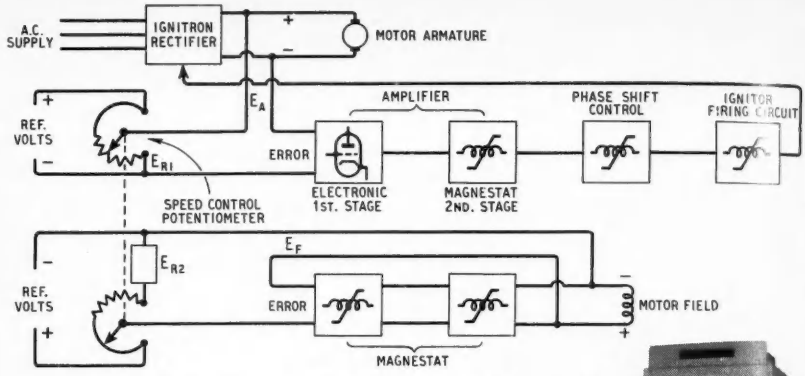
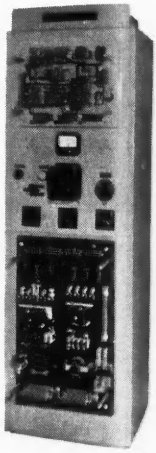


Fig. 8.—Ignitron motor control panels using magnestats, doors open



Above: **Fig. 9.—Simplified diagram of ignitron motor control circuits**



Right: **Fig. 10.—Magnestat voltage regulator panel**

magnestat for the field control is on the upper sub-panel. The ignitron rectifier is housed in the right-hand side cubicle and the intake supply circuit breaker in the centre cubicle.

In this application only one stage of electronic valve amplification is used. An earlier version of this form of motor control used valve amplifiers and firing circuits. The introduction of magnestats and magnetic firing circuits reduced the number of valves from 26 to 2, excluding the six power ignitrons. The employment of magnestats and magnetic firing circuits enhances the reliability of this part of the equipment, while the retention of a first stage valve amplifier facilitates stabilization of the regulator system.

A feature of a magnestat voltage regulator for a 4,500 kW alternator shown in Fig. 10 is the elimination of all moving contacts and electronic valves. The voltage bridge, used to measure the alternator voltage, comprises a linear arm and a non-linear arm, non-linearity being attained by magnetic saturation of a reactor. The voltage error from the bridge is passed by a magnestat to the field of an amplidyne connected to the exciter field circuit of the alternator. The upper panel of the regulator contains the voltage bridge and magnestat. Switchgear for changing from manual to automatic control is situated on the lower panel. Magnestat voltage regulators are capable of holding alternator voltage to better than $\pm$ 1 per cent. This type of regulator is being applied to the control of the largest of alternators.

It would not be proper to conclude without mention of the protracted development of the magnestat, which is not a new device. Literature on magnetic amplifiers dates from the beginning of the century. Progress in early days was hampered by available core materials and rectifying elements. The introduction of the selenium rectifier and, in more recent years, of improved magnetic core materials has enabled the magnestat to become a practical device.

Cooker Control Units

DOMESTIC cooker control units rated at 30 A up to 250 V for single-phase a.c. circuits only are dealt with in B.S.1833, which lays down dimensional, performance and safety features.

It stipulates inclusion of a shuttered socket-outlet complying with the B.S.1363 requirements, but the new Standard does not supersede or conflict with B.S.438. The latter is concerned with control units used in two-wire circuits of up to 250 V which, with its permissible alternatives, is of much wider application.

Copies of the specification are obtainable from the British Standards Institution, 24, Victoria Street, London, S.W.1, price 2s 6d post free.

VIEWS on the NEWS

By REFLECTOR

ONE does not often hear a good word said for the much-maligned electric fire—even by electricity supply authorities. I was therefore pleased to see that it is vigorously defended in the latest issue of the *Midlands Electricity News*. An open fire, it is pointed out, burns 3 lb of coal an hour; for the money that fire costs him the householder can run two single-bar electric fires for an hour and the nation will save 3 lb of good exportable coal at the cost of a smaller amount of slack. The writer adds that in lighting, cooking, water heating and power the savings are even more striking, and states unequivocably that "changing to electricity saves coal."

* * *

I note, in a Canadian journal, that the Electrical Contractors' Association of Ontario is redoubling its efforts to secure the licensing of electricians, feeling that this is the only way to give the public any guarantee of competent work. This was announced at the Association's annual convention when the delegates heard that the Premier had rejected a request for a system of licensing "because of possible objections by rural people who are accustomed to doing their own electrical wiring and maintenance." It was pointed out at the convention, however, that farmers were the chief victims of handymen and that a considerable loss of livestock and property was due to the faulty electrical wiring being done.

* * *

The practicability of joint readings of gas and electricity meters is at present being investigated and experiments are being carried out in several areas. Many people take it for granted that such a system must result in savings, but Mr. A. Heaton, chief accountant of the North Western Electricity Board, shows that this is not so. Writing in *Areatopics*, he points out that during the past four years a system has been built up by the Board which provides an even flow of work to the consumers' accounts section. This is important, as expensive billing machinery has to be maintained in this section. A second point is that, under the block tariff, it is essential that the periods between readings shall be kept as near as possible to 91 days, otherwise there will undoubtedly be complaints. The different kinds of meters—shilling and penny in the slot, quarterly, etc. — provide another problem. It has been found undesirable to mix slot meter collections and quarterly meter readings, but in many houses the gas meters are of one type and electricity the other. Finally, gas and electricity areas differ widely. Clearly it is a subject fraught with difficulties.

* * *

Most of us these days are inclined to take electricity very much for granted and it is only when we go into the less accessible parts of the country that we realize its full significance. The difference a supply of electricity can make was impressed on me strongly during a recent stay at a guest house on the River Exe. The first time I was there nearly twenty years ago oil lamps were used, food storage was a problem, and the temperature in the kitchen with its solid fuel cooker was almost unbearable: water pumping also presented some difficulties when starting a petrol engine in cold weather. On my return visit a few days ago I found a remarkable transformation brought about by the installation of a fairly large fully automatic diesel generating set (a mains supply still not being available). Apart from lighting, the installation providse for an automatic pump, a refrigerator, a food mixer, a fan in the kitchen, and a limited number of radiators. Operating costs are low and little maintenance is required.

* * *

"Britain Wins Big U.S. Order: £406,000 Contract for Supply of Giant Dam Generators" runs a headline in the *Daily Mail*. The report goes on to say that Ferranti officials were jubilant when the decision was made known. And mystified, I imagine, seeing that they had put in a tender for transformers.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AT the annual meeting of the Electrical Industries Benevolent Association, a report of which appears elsewhere in this issue, **Mr. R. H. M. Drake,** M.A.(Oxon.), was unanimously elected president for the ensuing year in succession to Mr. C. R. King. Mr. Drake is well-known throughout the electrical industry as chairman and managing director of Drake & Gorham, Ltd., and for his activities in connection with the Electrical Contractors' Association of which he has been three times president. It is particularly appropriate that he should hold office so near the time of the golden jubilee of the E.C.A. which has always been a strong supporter of the E.I.B.A.

Mr. R. H. M. Drake

Mr. Drake was born at Sanderstead, Surrey, in 1898 and was educated at Eton and Magdalen College, Oxford. He was engineer to his company before being appointed to his present position. In 1948 he was appointed a member of the Working Party on Building Operations set up by the Minister of Works.

Mr. F. Graucob, managing director of Nu-Swift, Ltd., has been elected chairman in succession to **Mr. A. Harland,** who has resigned owing to advancing years. Mr. Harland has accepted the honorary post as president of the company. **Mr. E. E. C. Cawood,** M.B.E., general manager, has been appointed technical director.

The University of Wales has conferred the degree of Doctor of Science *honoris causa* on **Mr. I. R. Cox,** D.S.O., B.Sc., M.I.Mech.E., A.M.I.C.E., managing director of the Metropolitan Vickers Electrical Co., Ltd., in recognition of his outstanding services to the electrical industry.

Mr. W. Harris, B.Sc. (Eng.), has recently joined Aberdare Cables, Ltd., and South Wales Switchgear, Ltd., and will represent these companies in North West England and North Wales. Mr. Harris obtained his degree in engineering at London and received his electrical training with Ferguson, Pailin, Ltd., with whom he was employed for about fourteen years, later serving for ten years with Manchester Corporation in the Construction Department. Since vesting date Mr. Harris has held the position of senior assistant construction engineer at the headquarters of the North Western Electricity Board.

Mr. A. G. H. Pritchett has been appointed general sales manager of Chamberlain Industries, Ltd. He has as his deputy **Mr. D. S. Jordan,** A.S.M.A.

On 11th July, **Plessey International, Ltd.,** the export sales organization of the Plessey group of companies, welcomed to an informal dinner and cabaret at Grosvenor House, Park Lane, London, visiting delegates to the British Commonwealth Signals Officers' Conference. Mr. B. G. W. Attwood, director of the Plessey Co., Ltd., and of Plessey International, Ltd., was in the chair.

Mr. E. C. Green has been appointed by the Aberdare Electric Co., Ltd., as their special representative to handle the sale of ' Thermodare '' thermal storage space heaters. He will operate from Little Reeves, Amersham Common, Bucks.

The wedding took place on Friday last at Caxton Hall, Westminster, of **Miss Hermione S. O'B. Hoare** and Lord Colwyn.

Lord and Lady Colwyn leaving Caxton Hall after their wedding on Friday last

Miss Hoare has for the past few months been public relations officer with the Electrical Industries Benevolent Association, and was previously publicity manager of Ferranti, Ltd., which she joined in 1942. She was one of the original members of the B.E.A.M.A. Publicity Committee, and was also a member of the B.I.F. Electrical Exhibitors' Committee. In May last a Master of Arts degree was conferred on her at Oxford University.

Mr. E. D. Hart, M.A., A.Inst.P., A.M.I.E.E., has joined the Equipment Division of Mullard, Ltd., where, as head of the Technical Department, he is responsible for market surveys, technical publications and other technical commercial activities. Before joining Mullard Mr. Hart was for many years with Marconi Instruments, Ltd., in an engineering capacity and latterly on the commercial side, where he was technical editor of "Marconi Instrumentation." Mr. Hart is also chairman of the recently formed Joint Advisory Committee on Radio Communication and Radar Measuring Instruments (R.C.E.E.A.-R.E.C.M.F.-S.I.M.A.).

Mr. E. D. Hart

A good attendance despite unpromising weather marked the sports day of **E. K. Cole, Ltd.**, which was held on the Ekco Sports Ground at Southend on 12th July. Several Essex County Championships were contested, and a county record was established in one event. At the prize giving which followed, Mr. E. K. Cole, chairman and managing director, presented a gold watch to driver W. J. Coe, to mark his completion of twenty-five years' service with the company.

A sports and gala day was held for the children of their employees by **W. J. Furse & Co., Ltd.**, on 5th July at West Bridgford. In addition to the races, there were a children's fancy dress parade, side shows, Punch and Judy show, roundabouts and other attractions. The occasion attracted about 500 people.

Part-time members of the fire brigade of **Hoover, Ltd.**, recently won the Guinness challenge cup, diploma and accompanying award in the five-men, four lengths of hose hydrant drill (wet) event at the eleventh annual competition of the London Branch of the Industrial Fire Protection Association held in the grounds of the Park Royal Brewery. They completed this event in 21.4 sec, beating the all-England record time by 2 sec, and will go on to represent the London area at the all-England finals which will take place at Lambeth on 13th September.

We reproduce herewith the portrait of **Mr. H. R. L. Lamont,** Ph.D., M.A., B.Sc., who, as we reported in our last week's issue, has been elected as an associate member of the Council of the Institution of Electrical Engineers. He is senior lecturer in electronics, Department of Electrical Engineering, Royal Technical College, Glasgow.

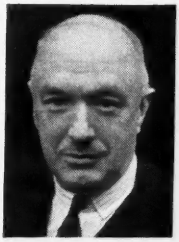
Dr. H. R. L. Lamont

The annual sports meeting of **Parnall (Yate), Ltd.**, was held at Alperton on 12th July. The Earl of Limerick, chairman of the company, attended and presented the president's cup to this year's winner, Mr. F. Hawkins, of the company's Yate factory.

OBITUARY

Mr. A. R. McClelland, a director of Falk, Stadelmann & Co., Ltd., has died at the age of eighty-one. Mr. McClelland had been with the company since 1886, and although he retired a few years ago from active business he remained on the board.

Mr. W. Brown.—The death occurred on 18th July at the age of sixty-four of Mr. William Brown, M.I.C.E., M.I.Mech.E., M.I.E.E., generation engineer (construction), East Midlands Division, British Electricity Authority. Mr. Brown was educated at Manchester University, and received his technical training with Willans & Robinson, Rugby, and with the Leeds Electricity Department. In 1910 he joined the Newcastle-upon-Tyne Electric Supply Co., Ltd., as an assistant engineer, and in the following year took up a similar post with the Scottish Central Electric Power Co. He was appointed an assistant engineer with the Brush Electrical Engineering Co., Ltd., in 1912, and a year later became assistant substation and transmission engineer with the Northmet Power Co. After service with the Royal Engineers in the 1914-19 war he returned to the Northmet Co. as resident engineer. From 1923 to 1930 he was H.M. electrical inspector of factories, and he



The late Mr. W. Brown

returned to the supply industry in the last-mentioned year as chief technical engineer, Central England, Central Electricity Board, a position he held until vesting date, when he was appointed to the East Midlands Division, B.E.A.

Mr. William Shearer, chairman of Duncan Watson (Electrical Engineers), Ltd., died on 16th July at the age of seventy. Mr. Shearer was also chairman and managing director of the Power Securities Corporation, Ltd., chairman of Balfour, Beatty & Co., Ltd., director of the Commercial Bank of Scotland, Ltd., chairman of the London board of the East African Power & Lighting Co., Ltd., Dar-es-Salaam & District Electric Supply Co., Ltd., chairman of the Perak River Hydro-Electric Power Co., and the Phœnix Assurance Co., Ltd., and a director of other companies.

A memorial service will be held at the Church of St. Martin-in-the-Fields, Trafalgar Square, on 30th July at 12.30 p.m.

Mr. E. Leslie Potter, chief chemist of the Micanite & Insulators Co., Ltd., died on 14th July at the age of fifty-six. He joined the company in 1919.

Mr. Henry William Lodge, street lighting superintendent at Halifax, has died at the age of fifty-eight. He formerly held a similar position at Burnley.

WILLS

Mr. J. R. Hawkes, principal of J. R. Hawkes & Co., electrical contractors, Leicester, who died on 13th April, left £9,362 gross (£9,313 net).

Mr. P. G. Spary, senior lecturer in electrical engineering at University College, Southampton, who died on 26th March last, left £10,845 gross (£9,849 net).

Sunderland Transport Deficit

THE Sunderland Corporation Transport Department, which operates 88 tramcars and 122 buses, made a loss of £20,529 during the year ended 31st March. The annual report states that expenses over which the Department has no control were the main cause of the deficiency. Additional costs have included £34,775 for increases in wages and salaries; £7,630 for fuel oil tax; and £2,963 for higher fuel oil charges. Last December the undertaking put into operation higher fares which are expected to bring in an extra £97,000 a year, but because of the higher fares there was a decrease of 0·9 per cent in the number of passengers carried. The report adds that a shortage of staff is causing anxiety.

STREET LIGHTING NOTES

AN application by SOUTHEND Town Council for sanction to borrow £4,000 for converting the street lighting at Shoebury from gas to electricity has been rejected by the Ministry.

Although the Ministry of Transport has informed BRADFORD Corporation that it will not be able to consider a scheme for changing from gas to electric lighting this year and has suggested that a new application should be made when the country's economic position improves, the Street Lighting Sub-Committee proposes to make further representations to the Ministry for the approval of two sections of the conversion scheme.

SOUTH SHIELDS Town Council has reduced from £6,000 to £4,000 the amount to be spent on improving public lighting in the town. The main part of the work relates to Sunderland Road (from Westoe to Cauldwell) at £1,200 and King George Road (from Cauldwell to Moore Avenue) at £1,728.

It was stated at a meeting of the OXFORD Highways Committee that consideration was being given to the question of converting the whole of the gas lighting in the city to electricity.

After a long dispute with the Ministry of Transport, LEAMINGTON Highways Committee has been granted permission to raise loans for £2,000 to extend fluorescent street lighting schemes. The Ministry had previously said the cost should come out of the rates.

NOTTINGHAM City Council, after long negotiations, has obtained the sanction of the Ministry of Transport to the completion of improved lighting in Valley Road. Approval has also been received for better lighting in Clifton Boulevard and Derby Road.

HASTINGS Town Council has approved a proposal to install automatic time switches in place of hand-operated street lighting switches at a cost of £18,700. An annual saving of £3,000 is expected.

BENTHAM (Lancs) Parish Council is to consider the possibility of replacing gas street lamps at High Bentham by electric lamps.

Asked by the divisional road engineer of the Ministry of Transport to reconsider its street lighting proposals in view of the need to restrict capital expenditure, MILVERTON Parish Council has replied pointing out the urgent need for approval of the scheme so that lighting can begin at the proper time.

BOOTLE Council is seeking approval of a scheme for installing sodium lighting in Stanley Road.

DURHAM City Council is seeking loan sanction for £3,000 for the provision of lighting in Saddler Street, Elvet, Church Street and Hallgarth Street, and £1,130 for similar work at Aldeyheads.

Public Authorities and Overhead Lines

The Legal Aspect

By F. E. SUGDEN

VERY properly, electricity undertakings are being extended to cope with increased demands for service, particularly in country districts where premises are far apart and where it is more economical and more practical to erect overhead cables than to use underground cables. To what extent are public bodies able to interfere with the erection of these overhead lines?

Malvern Hills Case

An important case which occupied the attention of the Chancery Division recently was that relating to the Malvern Hills. By a deed made between the Ecclesiastical Commissioners and the National Trust for Places of Historic Interest the Commissioners had agreed to impose on certain common land certain restrictive covenants for the benefit of named places and for the purpose of preserving public amenities. It was laid down that no act or thing should be done or placed or permitted to remain upon the land which would injure, prejudice, affect or destroy the natural aspect and condition of the land. This clause was duly registered under the Land Charges Act. When an Electricity Board subsequently entered on the common land and erected poles to carry an overhead line, the National Trust claimed an injunction to restrain the erection or maintenance of the poles.

The Court held that it was impossible to ascertain the limits of the prohibition contained in the restrictive covenant, which was, therefore, void for uncertainty. Further, notwithstanding the provisions of the Electric Lighting (Clauses) Act, 1947, the Court held that it was not incumbent on the Board to obtain the consent of the appropriate local authority to the erection of the poles. Further, it was held that the National Trust was entitled to enforce the restrictive covenant, and was therefore a body to whom an opportunity of being heard should be given before the poles were erected.

This ruling suggests that a local authority's power is restricted, particularly where a house is erected in the country, probably in an isolated spot and the owner decides to have electricity installed. There is nothing to prevent contractors from erecting poles to carry the line, provided they obtain the sanction of the private owners of the land and the local authority's power is considerably limited, if it exists at all in the circumstances.

If contractors are requested to carry out certain work, it behoves them to make sure that the work has obtained legal sanction. It is also advisable that the contractors should inquire into the powers granted to the undertaker before starting the work.

Unenforceable Covenants

The Court held in the case quoted that certain restrictive covenants were unenforceable. This is important where these restrictive covenants are too vague or uncertain. The law lays down that where there are any clauses in an agreement or contract which are not certain in their scope or not duly explained, they become void *ab initio*. They are consequently unenforceable and the contractors are safeguarded, because there are no prohibitions in existence, even though they are specified in the agreement. Some business men consider that because an agreement is by deed under seal it is enforceable; this is not the case, particularly where there is an uncertainty in the agreement itself.

Another point arises here which also shows that no sanction is necessary from the local authority where it deals with certain work on a private ground.

The contractor should be reminded that the local authority's permission must be sought to the breaking-up of roads which come within its purview and to the erection of overhead lines over highways.

Australian News

From Our Own Correspondent

THE Victorian State Electricity Commission's £3½ million loan which closed recently was undersubscribed to the extent of £1¼ million. The chairman of the Commission reports that subscribers numbered more than 4,000. The loan was the thirteenth public utility issue since interest rates were raised to 4⅛ per cent, and was the second failure.

The City Electric Light Co., Ltd., Brisbane, is offering 1,550,436 ordinary shares of £1 each at par to shareholders on the basis of one-for-six. The chairman, Mr. J. H. Holmes, says that directors are confident that, in the course of the next few weeks, representations to the State Government for a renewal of the company's franchise " will have an entirely satisfactory outcome."

An agreement has been reached between the Western Australian State Electricity Commission and the Fremantle Municipal Tramways and Electric Lighting Board for the sale of the Board's electricity undertaking for the sum of £700,000. Of this sum, £550,000 will be invested with the Commission at an interest rate of 4 per cent per annum. Interest rate will be reviewed at five-yearly intervals.

A power station costing £12 million will be erected at Port Augusta (South Australia) announces the Premier, Mr. Playford. This will be additional to the power station now being erected there and will double generating capacity.

The Western Australian Government Statistician reports that during the six months ended 31st December, 1951, imports from overseas included covered electrical cable and wire, £63,243; filament lamps, £18,184; radio equipment, £5,223; telephone and telegraph instruments and appliances, £59,884; electric heating and cooking appliances, £38,347; dynamo-electric machinery, £147,356; and other electrical equipment and appliances, £323,453.

In Sydney, a March census of retail stocks showed that electrical goods were up no less than 72 per cent. Firms retailing such merchandise as radio sets, washing machines and refrigerators are finding that sales are dragging badly. At the moment the man in the street cannot see ahead, and a feeling of unrest has led to very strong sales resistance.

The Victorian Government Statist reports that during the same period imports from overseas included dynamo-electric machinery, £471,974; radio equipment, £27,993; and other electrical machinery, etc., £1,721,043.

B.T.H. Summer School

THE second summer school conducted by the British Thomson-Houston Co., Ltd., attracted a large number of prominent personalities from the universities, technical colleges and the power supply industry to Rugby last week. They were welcomed cordially by Mr. E. H. Ball, managing director, and addressed by Sir John Hacking, president, I.E.E., prior to an introductory speech by Mr. L. J. Davies, director and chief of the B.T.H. Research Department. The visitors were kept busy for the whole week seeing the work that is in progress in many parts of the works and listening to twenty-one lecturers outlining the latest ideas and methods in research, electronic, power system, transformer, motor, rectifier, aero and auto and industrial engineering design and practice. Our illustrated report of this summer course has unavoidably had to be held over until next week.

Contract Price Formulæ

THE British Electrical and Allied Manufacturers' Association has issued the July figures for its contract price adjustment formulæ. In each case the rate of pay for adult male labour at 19th July is deemed to be 134s. The " cost of material " figures are as follows:—

For electrical machinery and equipment: The Board of Trade index figure published on 19th July is 167·6.

For turbo-generating and allied plant: Materials used in mechanical engineering industries, 151·7; blast furnaces and iron and steel melting and rolling (40 and 41), 142·6; price of ¾in o/d 18 s.w.g. brass condenser tubes (*Metal Bulletin*, 18th July), 3s. 9¼d.

Outstanding contracts covered by the Board of Trade intermediate products index: The index figure for intermediate products (19th July) is 361·7.

OVERSEAS ELECTRICAL TRADE

Exports Lower in June

ALTHOUGH exports of electrical apparatus and machinery increased in value from £73,509,605 to £95,832,279 in the first half of the year, the figures for June at £12,841,203 were £3,573,633 lower than those for May and only £517,100 above those for June last year. As reference to Table I will show, both electrical goods and apparatus and electrical machinery as a whole show slight improvements last month over the June, 1951, figures but all the electrical items in the general machinery section, which includes such items as washing machines, vacuum cleaners and tools, reveal a decline in trade.

Table II shows that Australia (£404,540) in June dropped to fourth place among purchasers of electrical goods and apparatus, India (£791,401), South Africa (£704,553) and New Zealand (£690,759) being the best markets. For the six months January–June, however, Australia still heads the list of buyers with purchases amounting to

TABLE I.—ELECTRICAL EXPORTS

Class	June, 1951	June, 1952
	£	£
Telegraph and telephone cables and wires (submarine)	8,100	6,280
Ditto, not submarine	433,391	782,238
Wires and cables, paper insulated	472,199	742,433
Ditto, rubber insulated	443,590	667,465
Ditto, cotton, silk or artificial silk insulated	44,890	42,858
Ditto, enamel, glass or asbestos insulated	75,530	56,656
Ditto, other	183,287	265,493
Commercial radio apparatus	414,923	492,413
Domestic radio apparatus	433,713	303,387
Telegraph, telephone and signalling apparatus	1,188,618	1,192,114
Radio loudspeakers	80,767	51,365
Telecommunication components, n.e.s.	450,463	425,962
Other telecommunication apparatus	132,925	88,919
Valves and cathode-ray tubes	331,156	220,448
Carbons	20,158	13,333
Lamps, exceeding 24 V	85,792	76,633
Ditto, not exceeding 24 V	33,873	34,435
Other lighting appliances	322,563	371,617
Primary batteries	191,821	146,993
Parts other than carbons	31,564	13,542
Accumulators for motor vehicles	245,051	191,502
Ditto, traction	18,186	10,068
Ditto, radio	11,639	5,041
Other portable accumulators	72,800	100,404
All other accumulators	42,179	113,667
Parts and accessories	85,783	66,202
Cooking appliances	235,085	109,473
Heating appliances	58,134	56,906
Parts and accessories for cooking and heating appliances	60,904	61,290
Flat irons	65,009	48,578
Commercial electrical instruments	105,919	94,742
House service meters	108,434	195,244
Time recorders and time switches	10,786	13,058
Other electrical instruments	85,741	87,307
Electro-medical apparatus (not X-ray)	40,567	29,114
X-ray apparatus, tubes and parts	140,481	86,209
Permanent magnets	22,017	29,908
Insulating cloth and tape	121,691	58,177
Other insulating materials	91,471	68,286
Unclassified electrical goods and apparatus	445,170	500,605
TOTAL, electrical goods and apparatus	7,446,870	7,920,365
Diesel driven generators not exceeding 200 kW	357,883	363,671
Ditto, exceeding 200 kW	121,251	209,229
Other generating sets	330,226	63,055
Generators exported without prime movers, and parts of generators	314,114	341,424
Motors, railway, tramway and trolley bus	700	2,279
Ditto, other, not over ½ h.p.	136,876	160,721
Ditto, over ½ h.p. but under 1 h.p.	73,973	51,363
Ditto, from 1 h.p. to 250 h.p.	413,998	407,174
Ditto, exceeding 250 h.p.	45,635	79,175
Ditto, parts	91,081	77,090
Converting machinery	12,109	19,799
Transformers, including coils	488,871	586,551
Rectifiers for power house use	67,914	52,176
Motor starting and controlling gear	170,257	193,063
Switchgear and switchboards (not telegraph and telephone)	967,361	1,176,966
TOTAL, electrical machinery	3,592,249	3,783,736
Washing machines (not exceeding 250 lb weight)	450,814	412,597
Ditto, parts	28,383	16,655
Vacuum cleaners	231,747	127,007
Ditto, parts	35,435	14,301
Other electrically operated portable appliances and parts	169,508	135,543
Portable electric tools	132,326	104,653
Unspecified electrical machines, machinery and parts	236,971	326,346
GRAND TOTAL	12,324,103	12,841,203

£5,406,116 compared with India's £5,165,159 and South Africa's £5,112,365. Canada, though not buying quite so much last month, increased its six months' purchases from £989,009 to £1,420,719. The total purchases of electrical goods and apparatus for the half year amounted to £57,508,318, compared with £44,264,996 in January–June, 1951.

Table II.—Distribution of Electrical Goods and Apparatus

Destination	June, 1951	June, 1952
	£	£
Channel Islands	49,516	32,839
Gibraltar	6,744	13,924
Malta and Gozo	8,145	11,532
Cyprus	18,544	21,050
British West Africa	140,988	171,886
Union of South Africa ..	712,005	704,553
Northern Rhodesia	19,419	91,210
Southern Rhodesia	97,287	156,560
British East Africa	209,069	176,865
Bahrein, Qatar and Trucial Oman	20,423	42,302
Kuwait		56,862
India	540,969	791,401
Pakistan	163,128	275,184
Malaya	368,177	311,836
Ceylon	103,102	66,022
Hong Kong	271,449	143,426
Australia	832,345	404,540
New Zealand	149,464	690,759
Canada	207,236	192,336
British West Indies	90,858	86,321
Anglo-Egyptian Sudan ..	31,408	60,791
Other Commonwealth Countries	54,417	67,677
Irish Republic	407,342	260,151
Soviet Union	2,738	—
Finland	38,033	73,249
Sweden	217,860	248,703
Norway	99,520	157,709
Iceland	21,021	5,812
Denmark	104,966	102,213
Poland	91,990	7,450
Germany	18,659	63,223
Netherlands	275,976	160,151
Belgium	124,527	107,570
France	77,183	78,561
Switzerland	39,986	60,931
Portugal	88,257	71,325
Spain	64,968	94,904
Italy	46,909	75,859
Austria	11,883	16,950
Czechoslovakia	7,035	5,206
Greece	44,556	78,183
Turkey	42,010	186,314
Portuguese East Africa ..	15,128	11,120
Syria	25,940	28,131
Lebanon	46,999	44,346
Israel	60,774	31,119
Egypt	274,617	158,730
Arabia	9,418	24,852
Iraq	21,852	151,729
Iran	24,645	14,749
Burma	49,512	105,774
Thailand	53,816	26,669
Indonesia	17,765	54,247
China	26,058	3,421
United States of America ..	127,561	84,092
Venezuela	46,372	60,342
Peru	73,816	42,455
Chile	16,493	20,215
Brazil	219,894	226,379
Uruguay	15,433	16,529
Argentine Republic	197,105	34,626
Other Foreign Countries ..	203,360	356,500
Total ..	7,446,670	7,920,365

Sales of generating equipment fell last month from £1,123,474 to £977,379 largely due to a reduction from £238,493 to £76,992 in shipments to Australia, whose purchases for the six months' period accounted for £1,308,974 of the £8,096,495 worth of this type of equipment disposed of. The decline of the Australian market also made itself apparent in regard to motors, sales here falling from £103,547 to £4[illegible],192 to make the total of £777,802 only slightly above the June, 1951 figure (£762,263): for the half year the total was £6,000,919 (£4,613,388). Australian demands for other types of electrical machinery were maintained (£183,439 compared with £180,353) and brought the totals for the month to £2,028,555 (£1,706,512) and for the six months to £14,785,731 (£10,728,151).

June's imports of electrical goods and apparatus at £659,098 were £3,792 lower than in the corresponding month of last year, but for the half year the total at £4,014,182 was £999,183 higher. The principal items for January–June were valves (£906,445) and radio and telecommunication equipment (£959,840). Holland (£1,174,858) and the United States (£664,521) were the biggest suppliers. The six months' imports of electrical machinery included generators to the value of £277,800 (£287,722), motors £310,007 (£189,749) and "all other sorts" £138,904 (£82,754).

Standard Charges in Wales

A NUMBER of questions about the standard domestic tariff (which came into operation at the beginning of the month) are answered by the South Wales Electricity Board. It explains why standardization was necessary, referring to the 300 different methods previously in force; why the number of rooms basis was chosen; why some rooms are included and some not; and why the old flat rates have been discontinued.

The Board points out that a misunderstanding is that the full number of kWh at the primary rate have to be paid for, whereas actually only the amount of electricity consumed is charged.

At its meeting last week the Consultative Council decided to ask the Board to review the new tariff at the end of December. It was felt that this would enable the Board to judge the operation of the tariff during a winter and a summer period.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Light-Gauge Conduit

I SHOULD like to commend Mr. A. V. Leighton on his article supporting the use of light-gauge conduit. Although an important point in the saving of steel was stressed, earth continuity resistance readings for conduit work constitute one of the most important factors, and it has been proved time and time again that screwed conduit installations leave a lot to be desired for the maintenance of earth continuity.

It is known throughout the electrical industry that screwed conduits are seldom drawn up tightly to resist corrosion. The use of worn dies is a contributing factor, although the importance of using pipe grips on every piece of conduit is not stressed sufficiently by supervisors, in which case although continuity resistance will be low on a new installation it will deteriorate rapidly with the age of the installation, whereas with lug-grip installations the continuity is tested on the completion of the job and it is proved that it will remain at the same figure for at least twenty years.

It is felt that a certain amount of prejudice has arisen over light-gauge conduit among electricians who think that this material is used only by the jobbing man. This prejudice has become stronger since a large number of engineers in the contracting industry have been drawn from electricians engaged in contracting.

London, S.W.2. R. A. WEBB, A.M.I.E.E.

I HAVE read with interest your contributor's article making suggestions on how to reduce the amount of steel used in the electrical installations of newly-constructed dwellings. While agreeing that the use of light-gauge conduit would effect a saving I cannot help feeling that such measures are still only of a superficial nature. Not only on the score of steel conservation but, of perhaps equal importance, that of economy, I maintain that the adoption of inflatable pneumatic tubing is imperative in the national interests.

Using as a basis the average length of 400ft of conduit per flat quoted by your contributor and the weight figures in his Table I for ¾in conduit, the following is derived:—

	Per 100ft, in lb	Per dwelling of 400ft, in lb	Saving, per cent
Screwed conduit ..	53	212	—
Light-gauge conduit	36	144	32
Pneumatic tubing and conduit .	—	13	91
Pneumatic tubing only	—	—	100

The explanation of the 13 lb of conduit per dwelling in the case of the pneumatic tubing is to allow for the use of light-gauge conduit for switch drops, but even this can often be dispensed with by the 100 per cent use of the tubing.

This takes no account of the saving in metal involved in the use of the special precast concrete ceiling boxes that are used in conjunction with the tubing. Moreover, attention must be drawn to the saving in labour which will be appreciated from the fact that 10-point layouts are positioned in less than one hour. I estimate that the overall saving in money would be of the order of some million pounds per annum.

A number of authorities are already enlightened as to the benefits to be derived from the adoption of this system and I am confident that in the future, irrespective of the question of steel shortage, it will become established as the recognized system of duct formation.

London, W.1. B. V. CUFFLIN, *Managing Director*, Ductube Co., Ltd.

London's Trams

AS one who has to travel a lot and has grown up with and known London's trams for over 40 years—during which time I have seen numerous extensions—I would

say they have not left a day too soon. The London of to-day has no room in its streets for a vehicle of this type which occupies the centre of the road and causes congestion in taking on and setting down passengers.

Since the start of the change-over road accident figures have shown a slight decline and when all tracks are removed there should be a further improvement. On the day when the trams were discontinued three accidents were reported in the local paper of this area to people boarding or alighting.

I have seen trams running in other towns in this country and in most cases they are serving a useful purpose mainly because the streets have nothing like the volume of traffic to handle as compared with London. The majority of these towns, if necessary, can with the addition of an extra mile or so, be by-passed by other traffic, which no doubt is done, but in London this is not possible; all traffic has to pass through, adding to the congestion.

The conduit system was thought to be an advance in progress at the time but that proved to be otherwise. Hold-ups were caused by the plough fouling the points and the car getting stuck on a "dead." All will agree, I think, that trams are not slow and that they can be made comfortable, as other towns have proved, but they lack flexibility in and out of traffic and are therefore "a confounded nuisance" as far as London is concerned anyway.

From personal experience in South London the introduction of the buses has created a more even flow of traffic and although the carrying capacity is less there are no longer the lengthy queues mainly because of this even flow. Prior to the last trams coming off, intending passengers always made for a bus in preference to a tram to avoid the hold-ups; consequently buses were always full when the trams were nearly empty at peak periods over duplicate routes.

It is well known that electric traction is the cheapest and there is no doubt that a trolley-bus system might have been a proposition but even then only for a short time. It has been argued that these do not pay owing to their speed. The conductor does not have time to collect all the fares of short distance passengers before they reach their destinations and this causes a loss in revenue. One body did put forward the idea that trolley-buses should be increased in size and provided with two conductors, one upstairs and one down, to avoid this.

While the introduction of buses may not be progress, as one of your correspondents puts it, it is at least a stop-gap. Progress in London's transport problem can only come in the form of a complete network of underground railways and this must surely come sooner or later.

*London, S.E.*4. CYRIL R. WATERER.

Stockholm Conference

THE Conference to consider the assignment of very high frequencies (ultra short wavelengths) for sound and television broadcasting in Europe, which began in Stockholm on 28th May and ended on 30th June, was the first of its kind because television and v.h.f. broadcasting on any appreciable scale by European countries is a comparatively recent development. The Conference was convened at the suggestion of the Swedish Administration and it was attended by representatives of 31 countries.

The world radio conference held in Atlantic City in 1947 allocated three bands to Europe, namely, 41–68 Mc/s (band I), 87·5–100 Mc/s (band II), and 174–216 Mc/s (band III). The Stockholm Conference has produced an agreement with which are associated three plans for the assignment of frequencies to European broadcasting stations, one for each of these three bands.

In band I the Conference accepted the assignments which the United Kingdom has made for the five high power television stations of the B.B.C. and for the five low power stations which are to open in due course. The way in which sound and television broadcasting services will develop in the United Kingdom in bands II and III has yet to be decided. But in order to secure the most favourable conditions practicable for the future development of United Kingdom radio services in those bands, provisional proposals, for sound and television broadcasting respectively, were submitted to the Conference.

For band II the delegation sought alternative sets of frequencies for amplitude modulation and frequency modulation and was successful in securing both sets, as alternatives, in the plan.

The agreement has been signed on behalf of the administrations of 21 of the 31 countries represented at the Conference, the non-signatories being Portugal, the U.S.S.R., and eight other Eastern European countries. The United Kingdom delegation signed subject to a formal reservation preserving complete freedom of action for the United Kingdom with regard to the use of frequencies in bands II and III.

The Stockholm plans will come into force on 1st July, 1953, and are due to be reviewed not later than 1st July, 1957.

Engineering in Europe

Survey of Current Literature

THE running-up of squirrel-cage motors driving heavy machine tools which are difficult to start is a special problem, particularly on account of the large starting current taken by the motors. In this respect the principle of the magnetic powder clutch has almost all the characteristics required, above all a linear relation between magnetizing current and coupling torque, and is, owing to its quasi-viscous transition between static and dynamic friction, an ideally shock-free operation.

The latter fact cannot be over-rated in connection with machine tools, because it is so essential for their service-life. But an equally important economic fact is that the use of the magnetic powder clutch permits one to choose the driving motor for the power required during actual work, not during a difficult start. A correctly dimensioned motor will be capable of starting the machine tool and will thereafter work at its optimum efficiency and p.f. This contrasts with the wrong, but hitherto unavoidable, method of designing, or selecting, a motor of high starting torque, thus being forced to use outsizes for such drives.—"A.E.G. Magnetic Powder Clutch, Type E.M.G., as Starting Clutch for Difficult Starting Conditions in L.V. Systems," H. Falderbaum and O. Grebe, *A.E.G. Mitteilungen*, Vol. 42, No. 3/4, pp. 104–109, March–April, 1952, in German.

Farm Wiring

Many sins against sound and safe principles of wiring are hidden behind the panel-boards of indoor distribution and fuse boxes. It is also true that these principles are difficult to carry through, increasingly so where the number of feeders, risers and branch circuits served by a central, or simply one large, fuse or distribution panel becomes too large. While muddled wiring in such boxes is always and everywhere dangerous to some extent, it becomes much more so at sites more exposed to atmospheric risks than others, e.g. farms in the mountains. This article presents a striking selection of such examples and of their consequences.

The remedy is rational separation of incoming and outgoing conductors; where necessary, the fuses are arranged in parallel vertical planes and panel construction is dispensed with. Many types of fireproof and partly iron-clad distribution centres for residential, public and industrial buildings are shown.—"New Viewpoints Concerning the Layout of Distribution and Protection Gear of Indoor Installations," A. Bernardsgrütter, *A.S.E. Bulletin*, Vol. 43, No. 9, pp. 333–350, 3rd May, 1952, in French.

Meter Jewels

The lower bearing of electricity meters must carry the comparatively large weight of the rotor and is therefore subject to much wear. This bearing consists conventionally of a jewel with a ground-in spherical cap in which a steel ball (of a radius half the length of that of the spherical cap) runs. Owing to the elasticity of the materials, the contact of ball and jewel is not a point-contact, but along a circular area. The total work of friction is proportional to the (constant) friction torque and the number of revolutions of the rotor whereas the wear does not depend on the total work of friction, but on the maximum specific friction work occurring at any point of the contact surface ball-jewel, this again being proportional to the maximum specific friction torque times number of revolutions. A reduction of the ball radius reduces total and increases specific friction, which shows that the total friction torque cannot be reduced at will without prejudicing the service life of the bearing.

The introduction of a self-centring double-jewel bearing in which the ball is more firmly held and is still at liberty either to slide or to roll, whichever is the "easier" method under the conditions

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

of loading, very considerably reduces wear in the bearing, so that the service life of a meter may easily be 20–25 years, during which time the increase in meter error is below 3 per cent at 5 per cent of the meter rating. These double-jewel bearings are not necessary for normal a.c. meters, the rotor weight of which is less than 30 g, but are a great improvement of three-phase meters with their far heavier rotors.—"Double Jewel Bearings for Electric Meters," B. Tibus, *A.E.G. Mitteilungen*, Vol. 42, No. 3/4, pp. 125–127, March–April, 1952, in German.

Ontario Commission Chairman Entertained

A COMPLIMENTARY luncheon to Mr. Robert H. Saunders, C.B.E., Q.C., chairman of the Hydro-Electric Power Commission of Ontario, was given last Friday at the Connaught Rooms, London, by the British Electrical and Allied Manufacturers' Association and the British Engineers' Association.

The function was informal and Mr. T. F. Lister, chairman of B.E.A.M.A. Council, who presided, introduced Mr. Saunders to the sixty members of the Associations and their guests present. In his address Mr. Saunders gave an interesting picture of recent developments undertaken by the Hydro-Electric Power Commission and paid a warm tribute to the assistance provided by the British electrical manufacturers.

Other guests included Mr. J. S. P. Armstrong, Agent-General for Ontario; Mr. R. P. Bower, Commercial Counsellor, Government of Canada; Mr. J. W. Sanger, member of the Hydro-Electric Power Board of Manitoba; Sir Frank Lee, K.C.B., C.M.G., Permanent Secretary, Board of Trade; Sir Eric Bowyer, K.B.E., C.B., Deputy Secretary, Ministry of Supply; Sir James Helmore, K.C.M.G., Second Secretary, Board of Trade; Sir William Rootes, K.B.E., chairman of the Dollar Exports Council; Mr. H. Oldham, C.B.E., U.K. Trade Commissioner in Toronto; Sir John Hacking, deputy chairman, British Electricity Authority and president, Institution of Electrical Engineers; Mr. R. R. B. Brown, deputy chairman, Southern Electricity Board; Mr. E. A. Mills, deputy chairman, London Electricity Board; Mr. V. A. Pask, chief engineer, B.E.A.; Mr. W. R. T. Skinner, deputy chairman, South Eastern Electricity Board; Mr. F. W. Smith, C.M.G., M.C., chief contracts officer, B.E.A.; Mr. S. F. Steward, C.B.E., chairman, South Western Electricity Board; Mr. W. G. S. Thompson, assistant secretary, B.E.A.; Mr. E. R. Wilkinson, commercial manager, B.E.A.; and Lt.-Col. E. H. E. Woodward, C.B.E., M.C., T.D., member of the B.E.A.

Above (left to right): **Mr. T. F. Lister (chairman, B.E.A.M.A. Council), Mr. R. H. Saunders and Mr. L. C. Gamage (deputy chairman, G.E.C.)**

Left: **Mr. D. Maxwell Buist (export director, B.E.A.M.A., and chairman, Institute of Export), Mr. R. H. Saunders, Mr. J. S. P. Armstrong and Mr. B. H. Leeson (director of B.E.A.M.A.)**

Losses in Three-Phase Networks

Effects of Unsymmetrical Loads

By T. F. WALL
D.Sc., D.Eng., M.I.E.E.

DURING the past twenty years the rapid development of electric heating for industrial purposes, such as the single-phase furnace, the graphite rod furnace, and the spot-welding appliances, has made it necessary to install phase-equalizers on a large scale. A wide range of such devices is now available, but in all cases they involve an undesirable addition to the costs which the consumer has to meet.

The linking-up of power networks, and a more generous dimensioning of the component parts of the local network, will result, in general, in withdrawal of many of the arguments now advanced against such single-phase loads, and will make it feasible to connect them directly on to the network without having to insist on the consumer installing a phase-compensating device.

The question has often been raised as to what are the objectionable features of a single-phase load on a three-phase supply network. Of course, in all cases where heavy single-phase loads are necessary, efforts will be made to distribute such load between the three supply lines, but such a method has its limitations. For example, a single-phase load may be of such a character that it cannot be subdivided, or, owing to the time-displacement of the individual single-phase loads, no effective balancing can be arranged.

Waveform Distortion

The characteristic feature of a symmetrical three-phase load is that the "active power" taken from the supply system is constant at every moment. A single-phase load, however, gives rise to a double-frequency component of the power circulation in the supply mains as well as distortion of the current and voltage waveforms. Such distortion may result in serious consequences, such as increases in the losses in the generator and the supply lines. When drastically large asymmetry occurs, the damping-grids of the generators become permanently loaded and, in consequence, they may become heated to a serious degree. Heating of the generators by such supplementary effects implies either a serious reduction of the permissible useful load, or an increase in the rated output of the machine.

Further, even with an ideally effective damping-grid system, the effect on the reluctance of the air-gap will give rise to asymmetry of the pressure wave and consequently a pressure drop in the line. In accordance with the V.D.E. rules, for example, the negatively rotating component of the three-phase symmetrical component analysis must be not greater than 5 per cent of the positively rotating component if the supply system is to be accepted as being symmetrical. A greater degree of asymmetry is not allowed because of the extra losses which will be developed by motors which are connected to the supply mains, and also because of the consequent distortion of the pressure wave from its rated value. This latter effect is of great practical importance because of its serious effects upon the performance of electric lamps which are supplied from the network.

Welding Load Problem

Within the last ten years a.c. welding has been developed for an immensely wide range of industrial purposes, and its wide applications have brought into prominence the special problems which are involved when large single-phase loads are connected to the three-phase supply network. In what follows it will be seen how the copper losses in the supply lines are greatly increased when a single-phase load is connected to the network.

Suppose that a supply network is symmetrically loaded with a non-inductive power of P watts (Fig. 1), the load network being arranged as a mesh-connected system of resistances $R\Omega$ per phase. If the current is

Fig. 1

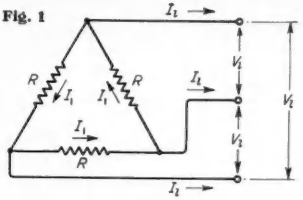


Fig. 2

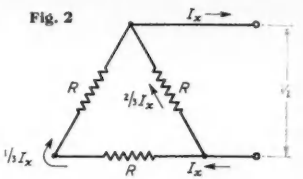


Fig. 1.—Supply network loaded with a non-inductive power of P watts, the load being a mesh-connected system of resistances R Ω per phase. Fig. 2.—Current distribution of a single-phase load of P watts connected to the supply network

I_1 per phase, the line current will be $\sqrt{3}\cdot I_1$ A per line, and the total power for the three phases will be

$$P = 3V_l \cdot I_1 = \sqrt{3}V_l \cdot I_l \text{ watts} \quad .. \quad (1)$$

and the losses in the network resistance will be

$$3I_1^2R = I_l^2 \cdot R \text{ watts} \quad .. \quad .. \quad (2)$$

Next suppose that a single-phase load of P watts is connected to the supply network as shown in Fig. 2. If the single-phase load current is I_x amperes, the current distribution in the network will be as shown in Fig. 2, so that the load on the supply terminals will be

$$P = I_x \cdot V_l \text{ watts} \quad .. \quad .. \quad (3)$$

Since, however, this load is to be equal to the three-phase load of Fig. 1, it follows from the expressions (1) and (3) that

$$P = I_x \cdot V_l = \sqrt{3} \cdot V_l I_l \text{ watts} \quad .. \quad (4)$$

so that

$$I_x = \sqrt{3}I_l \quad .. \quad .. \quad .. \quad (5)$$

The total losses in the supply lines due to this single-phase load will therefore be

$$\left[\left(\frac{2}{3}\right)I_x\right]^2 \cdot R + \left[\left(\frac{1}{3}\right)I_x\right]^2 \cdot 2R =$$

$$\frac{2}{3} I_x^2R \text{ watts}$$

that is $$2I_l^2R \text{ watts} \quad .. \quad .. \quad (6)$$

A comparison of the expressions (2) and (6) shows the important result that, for a given total load of P watts, the losses in the network when the load is single-phase is twice the magnitude of the loss when the load is a symmetrical three-phase load.

Power for the Rhodesias

THE first steps to carry out the great Kariba Gorge hydro-electric scheme for Southern and Northern Rhodesia are now being taken. The Roads Department of Southern Rhodesia has already started building a road over which heavy equipment is to pass for testing the bed of the Zambesi at two sites which have been suggested for building the Kariba dam wall. Some of the specially-designed equipment which will be used left Port Elizabeth in April. Other equipment which is being manufactured by a large firm of engineers in Johannesburg will be despatched to Kariba as it is completed. It is expected that drilling, which will be done from a specially-built pontoon moored on the river, will be finished by November, and soon after that the verdict on the two sites will be given. A camp is now being built for the men who are to do the drilling and superintend the assembly of the equipment as it arrives. One of their first tasks will be to assemble the eight-ton pontoon and bolt the machinery to its deck. Drillings will be made near the bank, but gradually operations will be extended across the stream. The drilling crew will live on the pontoon throughout the operational period and will be kept in supplies by launch. At the same time drilling will be carried out on the Northern Rhodesia side of the river in the sandstone formations there to examine them for porosity. The company doing the drilling will also examine the river bed below the two proposed dam sites as part of the preliminary work involved in the building of the bridge across the Zambesi.

IMPORTANCE OF BRAZILIAN MARKET

Prospects for British Trade

From Our Rio Correspondent

BRAZIL'S import trade in electrical machinery and apparatus increased considerably last year. The values of the principal items were as follows, with the 1950 figures in parenthesis:—Accessories for radio installations, £7,459,780 (£3,297,960); receiving and transmitting sets for radio-telegraphy and telephony, £1,713,240 (£899,280); electric lifts, £386,960 (£213,860); motors and generators, £8,575,180 (£5,920,560); accessories for electrical installations, £4,068,780 (£2,059,000); static transformers, £2,859,120 (£1,607,660); unspecified electrical machinery and apparatus, £14,149,760 (£7,761,440).

The above list does not include industrial machinery, although electrically operated, nor electric refrigerators and similar equipment. Imports of these two classes amounted to £23,889,660 and £5,646,980, respectively, in 1951, as compared with £13,410,200 and £1,852,160 in 1950.

Brazil's foreign trade rose to record levels last year. Exports increased by 36 per cent, to £650 million, while imports rose to £742 million, leaving an adverse balance of £92 million, whereas the balance in Brazil's favour in 1950 amounted to £90 million. No statistics are available to show how last year's unfavourable balance was made up, but it was largely due to the excess of imports over exports in trade with the U.S.A. As regards Anglo-Brazilian business, imports from Great Britain last year increased by 27 per cent, to £54·4 million, while exports to Britain rose by 63 per cent, to £66·4 million. There was therefore a balance of £12 million in Brazil's favour, against an adverse balance of £2·1 million at the end of 1950.

Licensing Policy

In view, however, of the overall deficit of £92 million in 1951, imports are being licensed with great restraint this year. The Export-Import Department issued 10,826 permits in October, 6,024 in December, 5,722 in January, 3,304 in February and 1,595 in March. This progressive decrease is explained by the exclusion of dollar purchases, whenever it was possible to switch to other currencies, and of non-essential goods unless imported under compensation deals. In the first quarter of this year licences were issued to import British electrical materials valued at £299,377, as compared with £374,107 during the last quarter of 1951. Except in the case of telephone materials these figures do not include articles ordered by public service companies, the nature of which is not specified in the licence.

Increased Purchases from Great Britain

Permits for imports from Britain this year include a number of items formerly obtained from the United States. Thus in February and March licences were issued to import electric pumps valued at £91,008. Among other British goods licensed were static rectifiers, £13,500, generators and motors, £65,364, transformers, £15,850, radio apparatus and accessories, £14,618, and electric tools, £4,443. Brazil urgently needs such items and will continue to import them against payment in non-convertible currencies.

The list of materials which may be imported without prior licence during 1952 includes all machinery, apparatus, equipment and spare parts for exploitation and industrialization of mineral and agricultural products, for the cement and metallurgical industries, slaughterhouses and cold storage plants, and for rural activities, such as chicken farming, bee-keeping, processing foodstuffs and extracting and bottling Brazilian fruit juices. These classes include much electrical material for mining and industrial use.

Projects recently drawn up by the Brazil-United States Commission, and approved by the President, include an expenditure of £8,750,000 for electrification of the Rio Grande do Sul railways. The programme will call for extensive electrical imports.

Competition for Brazilian business has become intense during the past year. The

Central Brazil Railway, in response to its call for tenders for 200 electric train units, has received offers from eleven manufacturers, representing Great Britain, Brazil, the United States, Japan, Switzerland, France and Belgium. Trade with Germany and Japan is developing rapidly, so also to a lesser extent is that with France, Belgium and Switzerland. German and Japanese trade missions have been visiting Brazil and an exhibition of Japanese manufactures was held at Rio in April. Liberal payment facilities are offered by several countries, with quicker deliveries than British firms are quoting. The latter are hampered by export quota restrictions, which recently caused them to lose a £2 million order from Brazil. In spite of these difficulties and the sharp competition, prospects for Anglo-Brazilian trade in 1952 are generally believed to be favourable.

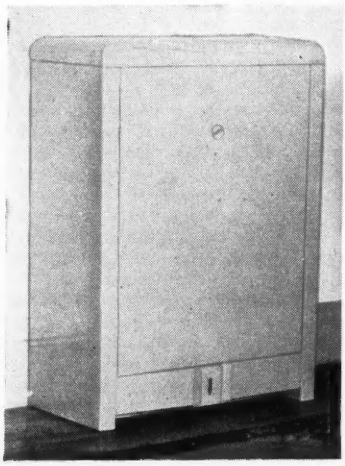
The German Allgemeine Elektricitäts Gesellschaft (AEG) is about to start work on a hydro-electric station at Rio Bonito, in Espirito Santo, which should be completed in 30 months. The local government is to build two other central stations, one in the north and the other in the south of the State. In April a contract was signed for a 60,000 kW hydro-electric station to be built at Canastra, Rio Grande do Sul. The station will cost £1,600,000 and should be ready in 34 months.

The President has signed a decree creating an "Executive Commission for the Electrical Manufacturing Industry." The principal object is to promote the manufacture of heavy materials and turbines. The Commission will fix a minimum production programme, decide what preferential treatment may be given to national and foreign enterprises and recommend State participation if sufficient private capital is not forthcoming.

Thermal Storage Space Heater

ARRANGEMENTS have been made by the Aberdare Electric Co., Ltd., Finglas, Dublin, to market the "Thermodare" thermal storage space heater in this country. This unit employs a solid refractory material as its heat storage medium, the heating elements being threaded through ducts. The whole is heat insulated and enclosed in a sheet steel casing.

"Thermodare" storage space heater



The apparatus is intended for connection through a time switch to the supply mains at off-peak periods for eight hours a day only. During the charging period approximately one-third of the heat input is radiated, the remaining two-thirds being stored and dissipated during the sixteen hours' discharge period.

The average surface temperature of a 1½ kW model in a room maintained at 65 deg F is 160 deg F at the end of the charge period. During the day there is a gradual decrease in surface temperature at about 4·5 deg F per hour until after about ten hours the rate of fall tends to be reduced to about 2·7 deg F per hour. This temperature gradient then remains constant until the time for recharging, when the average surface temperature is still about 100 deg F. Thus, sixteen hours after switching off, the heater is still giving out 920 B.Th.U. (equivalent to 270 W) per hour.

The heaters are designed for individual control and all the wiring can be done from the front with the heater in its usual position, an important point in view of the weight of the apparatus. At present two sizes are available with loadings of 1 kW and 1½ kW. The former measures 21in long by 11in wide by 22in high and weighs 274 lb; the latter is 8in higher and weighs 380 lb. With the standard finishes of cream and bronze, the prices are: 1 kW, 13 gns (plus £7 13s purchase tax); 1½ kW, £14 17s 6d (£8 6s 2d purchase tax).

E.I.B.A. Annual Meeting

Election of Officers

AN overall increase in general voluntary income is shown in the annual report for 1951 of the Electrical Industries Benevolent Association, which was presented at the annual meeting held at the Institution of Electrical Engineers, London, on Thursday last week. Despite this increase, revenue did not keep pace with expenditure, and the excess of expenditure over income for the last year was £1,108. The number of people helped increased by 138 to 1,265 as compared with 1950, and relief expenditure rose from a total of £36,999 to £40,418.

After giving some typical examples of cases in which the Association has provided assistance, the report refers to the continued success of Broome Park. Special mention is made of the donation of £1,000 received from the Electrical Contractors' Association to mark its golden jubilee. This money is being applied to the construction of a bungalow in the grounds of Broome Park as a separate amenity for a tubercular sufferer.

Mr. C. R. King, outgoing president, occupied the chair at the annual meeting, which was preceded by an extraordinary meeting at which a resolution was passed altering the rules of the Association to clarify its powers to borrow by bank overdraft or other means should that at any time be necessary.

Appeal for Further Support

In submitting the report and accounts for 1951 Mr. King referred to the loss which the Association had sustained by the death of King George VI and its deep appreciation of the honour accorded it by Her Majesty the Queen in granting her patronage. He said that the increase in the number of people helped during the past year (1,265 as compared with 1,127 in the previous year) was a sign that more people were taking advantage of the facilities which the Association afforded. He emphasized the need for additional support and said that the Association had balanced its budget, but this had only been done as the result of a great struggle which had, of necessity, diverted a great deal of the Association's potential energies from its real task of solving the personal problems of those in the electrical industry who were in need.

Mr. L. C. Sharp, chairman of the Court, in proposing the adoption of the report, said that although the number of tuberculosis cases showed no sign of lessening, there was a decline in expensive emergency private sanatorium treatment. The E.I.B.A. had helped more cases than in any previous year.

New President

At the Council meeting which followed, Mr. R. Hamlyn Drake, chairman and managing director of Drake & Gorham, Ltd., was unanimously elected president for the ensuing year. In handing over office, Mr. King mentioned that Mr. Drake had been three times president of the Electrical Contractors' Association, and he had done much to foster the support which the contracting industry had given to the E.I.B.A.

Mr. Drake thanked the Council for the honour paid him and said that it was a great compliment to the contracting industry. The year ahead would be a tricky one and the Association had an enormous task. He called upon the electrical industry to see that the progress was not only maintained but accelerated. He paid tribute to the work which Mr. King had done for the Association, and said that his recent invitation to the Royal garden party had wound up a wonderful year of office.

New Council members elected were Lord Burghley, Sir Henry Self and Mr. O. Pawsey. Mr. H. A. Deacon was elected chairman of the Court and new Court members are Sir Henry Self, Mr. M. R. Neville and Mr. O. Pawsey; it was decided not to fill the vacancy of vice-chairman for the present.

Commerce and Industry

Next Year's Power Convention

U.S. Contract for British Transformers

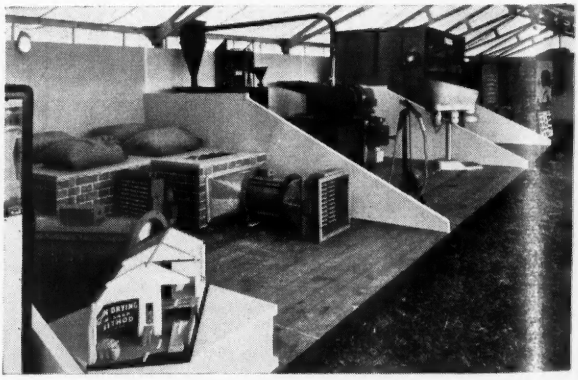
WE understand that an electrical exhibition is to be arranged in connection with the British Electrical Power Convention to be held at Torquay next year from 8th to 12th June.

Courses for Radio Technicians

Full-time three-year courses for radio technicians have been organized by the Ministry of Education and will start in September next at five centres in London, the Midlands and the North. They have been devised specially to meet the needs of the industry, the objective being to provide students so well trained in the theory and practice of electronics that they will be able, on completion, to take their places as assistants to qualified research and development engineers. The entry age will be 16 or 17 years. In the session beginning in September next, courses will be held at the Northern Polytechnic, Holloway Road, London; Norwood Technical College, Knight's Hill, West Norwood, London, S.E.27; E.M.I. Institutes, Ltd., 46, Pembridge Square, London; Coventry Technical College, The Butts, Coventry; and Bolton Technical College, Manchester Road, Bolton. The courses have the support of the Radio Industry Council. Details of the courses are obtainable from the principals of the colleges concerned.

Great Yorkshire Show

The accompanying picture shows the agricultural machinery display on the stand organized jointly by the Yorkshire Electricity Board and the North Eastern Electricity Board at the recent Great Yorkshire Show. The Board's stand was lighted by fittings appropriate to various situations in and around farm buildings. There was a good display of electrical appliances and machines which are now available to the farmer to assist or increase production from the land. Horticulturists were interested in the greenhouse in which were shown various electrical methods of soil sterilizing, soil warming and space heating as well as an installation for irradiating seedlings for the production of earlier and heavier crops. For the farmer's wife a representative range of all domestic appliances was shown and there were demonstrations of washing, ironing, cooking and fruit preserving.



Agricultural machinery display on the stand of the Yorkshire and North Eastern Electricity Boards at the Great Yorkshire Show

American Transformer Contract

The United States Defence Department has announced that it has accepted the tender of Ferranti Electric Inc. (a subsidiary of Ferranti, Ltd.), for nine British-made 33,000 kVA power transformers for installation at a dam project near Bismarck, North Dakota. The Ferranti figure of $1,137,605 was more than $200,000 below the lowest bid by an American company.

New E.T.U. London Offices

An informal ceremony was held at 39, Highbury Place, N.5, last week to mark the opening of the new London area offices of the Electrical Trades Union. Among those present, in addition to Mr. F. Foulkes (general president) and other officials of the Union, were representatives of the employers' sides of the District Joint Industrial Councils for the supply and contracting industries. They included Messrs. E. A. Mills, R. Lee and J. W. J. Townley (London Electricity Board), H. S. Smith

The new loading bay at the Bilston factory of the Quasi-Arc Co., Ltd.

(London district labour relations officer, B.E.A.), C. J. Veness (J. G. Sneath, Ltd.), J. Hall (Troughton & Young, Ltd.), S. L. M. Barlow (Barlow & Young, Ltd.) and A. J. Stiling (G. E. Taylor & Co. (London), Ltd.).

Mr. W. C. Stevens (general secretary, E.T.U.) explained that nearly a third of the membership of the Union was concentrated in the London area (actually 60,000, a five-fold increase in twelve years). The new premises had been bought freehold for £6,750 and a further £6,000 had been spent on alterations. The visitors then toured the building which comprises, on the ground, first and second floors, a board room to accommodate 40 people, offices of area officials and staff, etc., and on the third floor a caretaker's flat. The redecorations were carried out by the E.T.U. direct labour staff under Mr. J. Edmonds, estates manager: Pinching & Walton were responsible for the electrical installation work and a Reliance intercommunication system has been installed.

Wagons for Large Transformers

For moving transformers and other electrical equipment of exceptional size and weight British Railways have ordered two 24-wheel wagons, each 92ft long and capable of carrying a concentrated load up to 135 tons. Traversing mechanism will be provided to enable the loads to be moved to either side of the wagon to pass fixed structures such as bridges, signal posts, etc. The wagons, which will be built by Head, Wrightson & Co., Ltd., are expected to be in service by the late autumn.

Electrode Factory Extensions

Extensions to the factory of the Quasi-Arc Co., Ltd., Bilston, Staffordshire, have increased the area available for electrode production by 40 per cent. The extensions include a storage block for electrodes and welding plant and a loading bay where up to eleven of the company's transport fleet can be loaded at one time.

Plumber Jointers

The Joint Industrial Council for the Electrical Cable Making Industry has accepted the recommendation of the Standing Joint Committee on Plumber Jointers that the allowance to men employed in oil bays shall be increased to 3s per day as from 21st July last.

Royal Welsh Show

The display organized jointly by the Electrical Development Association and the Merseyside and North Wales Electricity Board at the Royal Welsh Show being held this week at Caernarvon draws attention to the many applications of electricity to farming. Actual farm buildings will be used to house the various sections, which include barn machinery, pig rearing, farm workshop, dairy, poultry, water pumping, and horticulture, the electrical equipment displayed showing clearly how electricity used in modern farming makes pleasant the work of the farmer and his employees and improves living conditions generally.

Portable Pipe Threading Machine

On Wednesday last week W.J.L. (Machinery), Ltd., Dacre House, Dean Farrar Street, Westminster, S.W.1, gave a demonstration in London of the Longworth "Junior" tangential pipe screwing machine which incorporates a number of new features. The machine weighs only 80 lb and embodies the same principles of design as machines many times its weight. It is equipped with a universal motor. Tangential dies

are employed, and the maximum capacity of the machine is 2in British Standard pipe thread. Any of the usual forms of thread may be cut, including conduit, B.S.P., parallel and taper threads. The tangential self-opening die-head is calibrated from ½in to 2in B.S.P. and/or ½in to 2in conduit. The speed of operation is 11 threads per minute up to ¾in and 5 threads per minute from 1in to 2in. The machine can be used without anchoring on the floor or bench.

Travelling Scholarship Awards

Among recipients of £50 travelling scholarships awarded by the Education Committee of the Worshipful Company of Tinplate Workers are Messrs. R. H. Blackley (Glasgow Corporation Transport Department), J. B. Matley (Metropolitan-Vickers Electrical Co., Ltd.), J. D. Waters (Mirrlees Watson Co., Ltd.), A. L. Powell (W. T. Henley's Telegraph Works Co., Ltd.), D. R. Eaton (Enfield Rolling Mills, Ltd.), and H. D. Johnson (Standard Telephones & Cables, Ltd.). Prizes of £10 each have been awarded to Messrs. D. Annandale (Yarrow & Co., Ltd.), and A. Jones (British Insulated Callender's Cables, Ltd.).

Iron and Steel Distribution

A number of technical changes have been made by the Ministry of Supply in the Iron and Steel Distribution Scheme by the Iron and Steel Distribution (Amendment No. 2) Order, 1952 (S.I. 1952 No. 1316). The changes, effective from 21st July, include: (a) Large springs have been taken off the directly controlled list. Manufacturers incorporating springs in their products now have to give springmakers a sub-authorization out of their main allocation. (b) The amount of electrical conduit which can be obtained without permit under the small quantities exemptions has been reduced to 3 cwt a month.

Relaxations have been made in the special present arrangements for economizing in the use of alloy steels containing nickel and molybdenum. The direction to steel makers has been amended and additions to the list of special-purpose steels not subject to restrictions include induction-hardening steels turbine blading steels, and steels prepared as a drawn wire in coil. These may now be used without permission from the Ministry of Supply's Director of Alloy Steel Control.

Metal Prices

The Minister of Supply (Mr. Duncan Sandys) has made an Order increasing the prices of secondary copper, brass, copper scrap, gilding metal scrap, brass scrap and cupro-nickel scrap to take account of the recent increase in the Ministry of Materials selling price of virgin copper. The Order, the Copper, Zinc, etc., Prices (No. 3) Order, 1952, Statutory Instrument 1952 No. 1317, came into force on 16th July.

Hire Purchase and Credit Sales

As from 21st July traders are permitted to charge the retail cash price of non-price-controlled goods when they are included in the same hire purchase or credit sale agreement as price-controlled goods.

Profit Sharing Scheme

The directors of the Electric Construction Co., Ltd., report that, in spite of difficulties over raw materials, the company has had another successful year and the employees' share of profits will be much the same amount as last year. Owing to the increase in wages, however, the rate in the £1 will be less, i.e., 1s 6d on the wages (excluding cost of living bonus) paid for the past year.

Lighting for Outdoor Boxing

Special lighting was installed for an important outdoor boxing contest which was held in Nottingham last month. The whole of the lighting, which included special lighting for the ring, searchlights at the four corners of the ground, safety lighting in the stands, and also sound equipment to cover the whole area, was installed by W. J. Furse & Co., Ltd. The contest was witnessed by 37,000 people.

Lighting for a boxing contest at Nottingham. The installation was carried out by W. J. Furse & Co., Ltd.

Industrial Research Fellowship

A fellowship valued at £1,000 (Australian) is offered to students in any branch of industrial research by the British Memorial Fund established in Victoria by public subscription. It provides for ten months' study in Victoria for the selected candidate, and covers all travelling and living expenses during the period. The upper age limit, for both men and women, is 35 and the lower limit 25. The fellowship is open to any well-qualified students of industrial management or some branch of social science; to office bearers in any chamber of manufacturers, federation of employers, or junior chamber of commerce; trade union office bearers; executives in industrial undertakings; and any person with experience in industrial affairs or general administration. Research will be encouraged into any aspect of Australian industrial life with special emphasis on Anglo-Australian and trade relations. Full details can be obtained from Sir John Lienhop, Victoria House, Strand, W.C.2. Applications will be received during the next four weeks.

Fatal Shock from Hair Dryer

Giving evidence at an inquest on a girl who received a fatal shock while having her hair dried, Mr. J. Smith (North Western Electricity Board) said he discovered two faults. First, a taped joint in the lead to the electric motor was bare and he thought it made the machine alive; and secondly, the electric plug to the wall socket was not properly earthed. There was nothing to suggest to the hairdresser that it was not safe. The hairdresser said it was two years since the drying machine was overhauled. She thought it was properly earthed because it had a three-pin plug. A verdict of "Death from misadventure" was recorded.

Institute of Metal Finishing

The Council of the Institute of Metal Finishing has approved the establishment of the following medals and awards made possible through the co-operation of three of the corporate members of the Institute.

The Mond Nickel Co., Ltd., has endowed the annual award of a palladium medal (with which will be associated a sum of £50) for an initial period of seven years. The award will be presented to a person of eminence selected by the Council of the Institute who will be invited to deliver a lecture in memory of the late Mr. A. W. Hothersall to be known as the Hothersall Memorial Lecture. Johnson Matthey & Co., Ltd., are presenting a silver medal which will be awarded annually, or at such times as may be decided by the Council, for the best paper presented to the Institute on the deposition of precious metals. The Westinghouse Brake & Signal Co., Ltd., has endowed an award for the best publication appearing in the journal of the Institute which, in the opinion of the Publications Committee, shows the most valuable advance in the science or practice of electrochemistry in general and electrodeposition in particular. The award will amount to £25 annually and will consist largely of a selection of books. Papers should be submitted to the Institute at 32, Great Ormond Street, London, W.C.1.

Prices of Materials

In the accompanying table we give the prices of the more important materials used in the electrical industry. The figures are those quoted on Monday last.

ALUMINIUM Ingots	ton £157 0s 0d
COPPER, H.C. Electro	ton £287 0s 0d
Fire Refined 99·70 per cent ..	ton £284 0s 0d
Fire Refined 99·50 per cent ..	ton £276 0s 0d
COPPER Tubes	lb 2s 8½d
Sheet	ton £344 0s 0d
H.C. wire and strip	ton £320 0s 0d
LEAD, English	ton £132 10s 0d
Foreign	ton £131 0s 0d
MERCURY	flask £65 10s 0d
TIN	ton £965 0s 0d
ZINC, G.O.B. Foreign	ton £130 0s 0d
Electrolytic	ton £134 0s 0d
BRASS Tubes	lb 2s 3⅝d
Sheet	lb 2s 6¼d
Wire	lb 2s 9½d
PHOSPHOR BRONZE	
Wire	lb 4s 1⅞d
RUBBER, No. 1 R.S.S. spot ..	lb 26½–26¾d

Radio for Gliding Championships

At the World Gliding Championships in Spain, in which Mr. Philip Wills and Flt.-Lt. R. C. Forbes, R.A.F., were winner and third respectively, the British team used radio-telephone equipment for the first time for direct and continuous communication between the airborne gliders and their attendant cars. The radio-telephone equipment, which was lent by Pye Telecommunications, Ltd., consisted of one of the new Pye "walkie-phones" weighing only 8 lb, fitted into each sailplane and a mobile radio-telephone unit (similar to that installed in London taxis) installed in each of the attendant cars.

Canadian Electrical Trade

Canada's imports of electrical apparatus during the first quarter of 1952 totalled $31,055,000 in value, an increase of about 12½ per cent on the corresponding period of 1951. This total was nearly four times the value of exports, which advanced by approximately 115 per cent during the same period. There were noteworthy increases in imports from the United States of batteries, dynamos and generators, transformers and the telegraph and telephone group; and from the United Kingdom of the larger capacities of motors (75 per cent), telephone apparatus (50 per cent) and unspecified electrical apparatus (nearly 400 per cent). West Germany improved her

position in a few lines. Canada's leading exports to the United Kingdom were motors and some radio apparatus. To the United States they included a big increase in radio apparatus, telegraph and telephone equipment, transformers and motors.

Trade Announcements

The activities of **Chamberlain Industries, Ltd.**, in Scotland are being handled by Gerard Wakeham, Ltd., Carlton House, 26, Blythswood Square, Glasgow, C.2.

From 5th August the address of **Dormor & Co., Ltd.**, Bournemouth, will be Haviland Mews, Haviland Road, Boscombe, Hants (telephone : Boscombe 37346).

Sparklets, Ltd., have removed to Queen Street, Tottenham, London, N.7.

Cigarette Manufacture

In connection with the article on "Cigarette Manufacture" in our issue of 11th July, the Watford Electric & Manufacturing Co., Ltd., informs us that in addition to supplying the switchboard for the refrigeration plant it was also responsible for the starter switchboards for the nine separate air conditioning plants.

Airfields Strike

Owing to a dispute involving about 100 electricians employed on nine airfields in East Anglia, all negotiations, including those for a substantial wage increase for 40,000 workers, between the Electrical Trades Union and the National Federated Electrical Association, are at a standstill. The strike, which is official, followed the dismissal of five workers, three of whom are stated to be shop stewards. The airfields are being taken over by the United States Air Force, and the contracting firm, E. Dyne & Co. of Newmarket, appointed by the Air Ministry, had engaged extra labour for the work.

Mr. L. C. Penwill, director and secretary of the National Federated Electrical Association, said in a statement on 18th July the facts were that the employer gave notice of dismissal to five electricians whose services were no longer required as a result of falling off of work. No other work was available for them.

Carbon Black

At the Stanlow factory of Cabot Carbon, Ltd., described in our last issue, the electrical contractors were Electric House (Denton), Ltd., not Denton Electric, Ltd., as stated.

No Staggered Hours

It was stated at a meeting of the Midland Regional Board for Industry that the 10 per cent load reduction required next winter could be achieved without altering working hours. The North Western Regional Board has also indicated that staggered hours will not be necessary.

Annual Holidays

Yorkshire Copper Works, Ltd., announce that their works will be closed from 1st to 18th August. From 5th August the company will be able to supply customers' requirements only from stock. The offices will be open as usual.

The works of the Hepworth Iron Co., Ltd., will be closed from 9th to 25th August.

The works of Peppers of Woking, Ltd., will be closed from 8th to 25th August.

Catalogues and Lists

Keith Blackman, Ltd., Mill Mead Road, Tottenham, London, N.17.—26-page catalogue giving details of "Tornado" axial (ring mounted) fans (Publication No. 27).

J. H. Fenner & Co., Ltd., Marfleet Avenue, Hull.—Two illustrated catalogues : taper-lock pulleys and bushes and V-belt drives in Swiss textiles factories.

Manchester Oil Refinery, Ltd., Twining Road, Trafford Park, Manchester, 17.—Technical brochure on "Supramor" electo-magnetic flaw detection ink.

Petbow, Ltd., Richborough Works, Sandwich, Kent.—Illustrated folder and price list of engine driven a.c. generating sets.

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Comprehensive illustrated catalogue of street lighting equipment.

Joyce, Loebl & Co., Ltd., Vine Lane, Newcastle-upon-Tyne, 1.—Illustrated priced folder on "JLC" low-voltage power units for school laboratories, universities, research laboratories, etc. (52/4).

Information Department

THE extensive records of our Information Department enable us to reply to most queries, but occasionally we ask our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the makers of the following:—

"Power" 2-pin plug tops.

General inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by the Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Arctic Power Scheme

Inauguration of Harsprånget Plant

A MILESTONE in hydro-electric engineering was passed on 19th June when, as already briefly recorded, King Gustaf Adolf of Sweden inaugurated the important Arctic power development scheme which has been proceeding for the past seven years.

The project will cost Kr. 270 million (£19 million) and involve the building of a 350 MW power station at Harsprånget and an overhead trunk line for transmitting power at 380 kV down into central Sweden from the desolate northern regions. This new source of 2,000 million kWh a year corresponds to about one-tenth of the country's total electricity production.

The Harsprånget plant is the second big power station on the Lule River in Lapland. The first, and the first underground station in Sweden, was the Porjus station of 135 MW, taken into use in 1915, and situated some 6 miles upstream northwest of the plant just inaugurated. A further plant is under construction on the Ligga rapids, a short distance downstream from Harsprånget. When in a couple of years this plant, designed for 145 MW, is in operation 676ft of the river's 1,200ft of total head will have been harnessed. Full exploitation of the Lule River is estimated to produce 9,500 million kWh, corresponding to 15 per cent of Sweden's total exploitable water-power resources, which have recently been calculated at 60,000 million kWh a year.

Arduous Conditions

Up to 1,100 employees have been engaged on the building of the Harsprånget plant, working three shifts a day in the darkness and severe cold of the long Lapland winters and by the light of the midnight sun during the short summers. The work started with the building of a barrage 2,520ft long and 164ft high across the river and a smaller 2,130ft barrage along one of the banks for creating the big reservoir. While this work was going on the water was led off beneath the building site through a specially blasted tunnel, making the river disappear and reappear 700ft downstream. The main dam is of an interesting design. The concrete structure thickness is only 1ft 4in while on each side there is a supporting filling of clay, sand, gravel and rubble from the blasted rock tunnels. Special methods were used for packing the filling material: in all 42 million cu ft of rubble, corresponding to the volume of the Pyramid of Cheops, and 12 million cu ft of fine-grained material were used.

Underground Power-House

The underground power generators and transformers are situated in a gallery of big rock halls 240ft below the surface. From the large power dam the water descends 350ft to the three Francis turbines installed so far, there being space for one more. The water then goes back into the river bed through a discharge tunnel blasted out of the rock of a length of 9,500ft and a sectional area of 2,050 sq ft. In area this is the largest power plant tunnel in the world of its type, but it will shortly be surpassed by a discharge tunnel that is at present being constructed by the State Power Board in connection with the Kilforsen plant on the Angerman River. In all, 30 million cu ft of underground rock has been removed at Harsprånget and every chip has been economically used for constructing the dam.

The machinery hall, 330ft long and as high as a five-storey building, houses the three 115,000 kW generators and in an adjacent rock hall are three single phase transformers, aggregating 345,000 kVA, with a fourth as a stand-by. They step up the 16 kV generated to 380 kV. The stator of each generator weighs 234 tons; the rotor, of nearly 23ft diameter, weighs 475 tons. The generators, transformers and most of the other electrical equipment have been supplied by the A.S.E.A. works, of Vasteras.

The Francis turbines, delivered by the firms of Nydqvist & Holm (two sets) and Karlstads Mekaniska Werkstad (one set) are capable of " consuming " 3,800 cu ft of water a second. The runner is made of stainless steel and weighs 32 tons, while

the distributor is still heavier. The turbines are connected to the generators by means of a 19ft 2in shaft, wholly forged, of a diameter of 3ft 3in and weighing 32 tons.

Heavy trucks, tractors, excavators and mechanical loading machinery have been in operation everywhere. The "Swedish tunnelling method" with the light "Atlas" one-man pneumatic drill and "Coromant" (wolfram carbide) tipped steel drills have made it possible to drive the tunnels considerably faster than previously, while at the same time substantially lowering the costs. For every "round," 100 holes 20ft deep were drilled and charged with about 0·45 ton of explosives. On an average about 23,000 cu ft of solid rock was removed each "round." In all, the blasting job required 330 miles of fuse. Prefabricated scaffolding and moulds, easy to assemble and dismantle, have been employed for concreting jobs, as well as circular sliding moulds for circular structures; 9,524 tons of reinforcement iron has been employed as well as 767,711 bags of cement.

Transmission at 380 kV

The 380 kV transmission line, inaugurated by the King on the same occasion, from the Lule River to Hallsberg in central Sweden, which has also been built by the State Power Board, has cost Kr. 103 million (£7 million). By adopting 380 kV in place of 220 kV (so far used for the Swedish trunk lines) the capacity has been greatly increased. Whereas with 220 kV four separate lines would probably have been required, one is sufficient for transmitting the power from Harsprånget and the Liggaforsen plant now under construction, representing great savings of material and money, not to mention productive forest and agricultural land. In addition to the large-capacity transformers the provision of two conductors for each phase, increasing the transmission capacity of the line, is a constructional feature.

This line, which includes two secondary transformer stations at Midskog and Hallsberg, passes right through trackless forests and sparsely populated areas. With the aid of 600 workers, 60 tractors and a large number of excavating machines, amphibious tanks, trucks and trailers it was completed in four years according to plan.

In all, 75,000 tons of steel structures and cable have been transported to 3,000 work places. As an example of the universal use of the tractors it may be mentioned that one tractor was arranged to pull out simultaneously all the eight cables. This cable is of a special steel-aluminium type called "Feral," produced by the Svenska Metallverken. It is 30 per cent stronger than copper cable, weighs 30 per cent less and is estimated to have made a saving in cost of about 40 per cent. The present transmission capacity of 450 MW can be further increased by the adoption of series-capacitor stations. One is at present being tested with good results in the Swedish 220 kV network. By means of equipment of this kind it is considered to be possible to obtain an ultimate transmission capacity of 800 MW per line in the Swedish trunk-line system.

The prospecting as well as the actual construction has been done by the State Power Board in collaboration with several hundred Swedish firms. Only a few minor details of equipment came from foreign suppliers.

The head of the Swedish State Power Board is Mr. Ake Rusck.

The *Svenska Dagbladet* published on 15th June a special 36-page "High Tension World Record Supplement" in English describing, with illustrations, the Harsprånget project and also the 380 kV transmission system.

Pakistan Mill Electrification

THE Government of Pakistan has recently sponsored a project for increased production at the Fauji textile mill, at Kala in the Punjab. This mill, which is operated by the board of the Post War Services Reconstruction Fund, has a present capacity of 25,184 spindles and extensions now in progress will enable the output to be doubled. To drive the new machinery the General Electric Co., Ltd., is supplying a total of 218 squirrel-cage motors, together with starters of the D.T.L. type. Of this total, 122 machines are of the standard industrial pattern with outputs ranging from ½ h.p. to 12 h.p., while the remainder are 1½ h.p. motors specially constructed for carding engine drives.

Further extensions to the Pakistan textile industry are taking place in East Punjab, where a number of new jute mills are being erected for the Pakistan Industrial Development Corporation. For these mills the G.E.C. is supplying ninety-eight 400/440 V squirrel-cage and slip-ring motors totalling 2,800 h.p.

ELECTRICITY SUPPLY

Output Again Lower in June

Textile Mill Power Costs

IN June, for the third successive month, the quantity of electricity generated by the British Electricity Authority, the North of Scotland Hydro-Electric Board and the Lochaber Power Co. was less than in the corresponding month of last year. The actual rate of decline, however, was only 0·02 per cent compared with 3·2 per cent in May and 4·0 per cent in April. For the first half of the year, the total of 31,290 million kWh generated represented an increase of 1·6 per cent over the corresponding six months of 1951, as shown in the table below.

At the end of last month plant installed in power stations of the B.E.A. and in the North of Scotland area aggregated 16,636 MW, an increase of 308 MW during the half-year. In June the following new plant was installed by the B.E.A.:—30 MW set and 305,000 lb/hr boiler at Huncoat; 50 MW set at Poole; 230,000 lb/hr boiler at Nechells "B"; 130,000 lb/hr boiler at Bromborough; 360,000 lb/hr boiler at North Tees; 240,000 lb/hr boiler at Staythorpe; and 200,000 lb/hr boiler at Rotherham.

Huncoat Power Station Extension

The British Electricity Authority has received the consent of the Minister of Fuel and Power to the extension of the Huncoat power station, Accrington, by the installation of a fifth 30 MW turbo-generator set. Originally designed to house four 30 MW sets, the first of which came into operation last month, the Huncoat station will thus have an installed capacity of 150 MW when completed.

Steel Shortage at Carmarthen Bay

Referring to reports of men being declared redundant at Carmarthen Bay power station, the contractors' agent recently informed Burry Port U.D.C. that the steel position, which had steadily deteriorated in the early part of the year, had become so acute that certain sections of the work had to be cut. If steel supplies were forthcoming in the near future there was every possibility that full-scale construction would be resumed.

Gas Turbine Plant

Mr. A. R. Coope, controller of the North Western Division of the B.E.A., announces that the 15 MW gas turbine at Old Trafford, Manchester, is likely to start operating soon.

Fife Power Plan

It was reported to Fife Water Supplies Committee that there had been a hitch in the Fife County Council's plan to generate electricity at the new reservoir it is building at Upper Glendevon. Some differences of opinion on financial arrangements had arisen between the Council and the North of Scotland Hydro-Electric Board. It had been estimated that the annual expenditure on the scheme would

ELECTRICITY GENERATED AND PLANT CAPACITY

	Fuel consumed Thousand tons		kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Oil	Steam	Water power	Total*		
British Electricity Authority ..	2,303	3·7	4,033	12	4,051	3,802	15,992
North of Scotland	17	1·1	25	85	114	113	644
Total for June, 1952	2,320	4·8	4,058	97	4,165	3,915	16,636
Corresponding total for June, 1951	2,393	5·5	4,077	78	4,166	3,919	15,298
Increase or decrease, per cent ..	−3·1	−12·7	−0·5	+24·4	−0·02	−0·1	+8·7
Total for year to date (6 months)	17,006	35·1	30,328	883	31,290	29,506	
Total for corresponding months of 1951	17,640	50·3	29,970	721	30,791	29,081	
Increase or decrease, per cent ..	−3·6	−30·2	+1·2	+22·5	+1·6	+1·5	

* The total includes 6·6 million kWh generated by oil engines and 3·3 million kWh by waste heat plants in June, 1952.

be £2,200 and that there would be an income from a sale of power to the Board of £3,125 to give a profit of £925. A meeting is to be arranged with the Board to try to reach an agreement on the points in dispute.

Consultative Council Machinery

So that, if at any time changes in consultative council machinery are considered desirable, it will be in a position to make definite recommendations, the Eastern Electricity Consultative Council is setting up a sub-committee to review the work of the Council. This was announced by the chairman (Ald. W. J. Bennett) when the Council met in London last Friday.

Eastern Area Activities

A statement of work carried out by the Eastern Electricity Board, submitted at last week's meeting of the Consultative Council, showed that in April and May 5,745 new consumers were connected, including 80 farms. Mains extensions aggregated 65·5 miles (h.v.) and 48·7 miles (l.v.). On the minute of the Northmet Local Committee, it was reported by the secretary (Mr. L. A. Jackson) that the wind generator at St. Albans was not now expected to be ready until early next year.

Services in Council Houses

At a special meeting of the Bath Housing Committee proposals for services in 415 houses on a new estate at Foxhill were approved. Water heating will be by back-boiler with an electric immersion heater for use in the summer months. Each house will have four electric and four gas points, enabling the tenants to choose between electricity and gas for cooker and wash-boiler. It was stated that the average estimated cost of installing these services was £55 12s per house.

Gas Contract Cancelled

Because 80 per cent of tenants of Lockerbie's Sydney Place housing scheme chose electricity rather than gas a contract with the Scottish Gas Board for the laying of gas mains is to be cancelled.

"All Electric" Houses

Bridgwater Town Council has decided, as an experiment, that 18 houses to be erected in Penlea Avenue shall be supplied with electricity services and equipment only. It was stated that there would be a saving of about £70.

Transfer of N.C.B. Networks

At a meeting at Newcastle-on-Tyne of the North Eastern Electricity Consultative Council it was reported that during the three months March to May the North Eastern Electricity Board had approved estimates amounting to £1,134,512 in connection with electrical work for 79 housing schemes and 35 rural supply schemes. The Board has been in touch with the N.C.B. regarding the transfer of networks under the control of the Coal Board and agreement has been reached for the transfer of the supplies at Lynemouth, Linton, Ellington Colliery, Ellington Village and Cresswell (in the Tyne Sub-Area). Following the approval of the estimates covering the cost of the transfer, orders for materials had been placed and other preliminary work started. Surveys had been made for the transfer of supplies at Woodhorn Grange, Ellington East and West Moor Farms (Tyne Sub-Area) and Cornsay, East Herrington and Middle Herrington (Wear Sub-Area).

Electricity for Textile Mills

Mr. W. T. Winterbottom, chairman of the Fine Spinners & Doublers, Ltd., stated at the annual meeting in Manchester on 11th July that the additional cost to the company of the new tariffs of the North Western Electricity Board for mills on full-time running would be £90,000 a year and, even to limit the increase to that extent, it would be necessary to spend £80,000 on power equipment. Many spinning and doubling mills were admittedly on advantageous tariffs, but the new rates had been particularly severe on the company and represented an increase on cost per kWh of approximately 45 per cent. The maximum demand charge was particularly unfair on mills running a few days a week and in some cases the light and power costs were over 3d per kWh. Nothing had yet been done about the protest made by the Master Spinners' Federation more than three months ago.

Proposed Fuel Charges Committee

Coun. A. Critchley, chairman of the former Liverpool Electric Power and Lighting Committee, has submitted to the City Council a motion proposing the establishment of a Fuel Charges (Special) Committee to consider the general question of the charges made for gas and electricity in the city, and in particular, the recently revised charges for electricity. The motion has been referred to the Finance and General Purposes Committee for consideration and report.

Rewiring Northern Polytechnic

The London County Council Education Committee has approved a scheme for the renewal of the electrical installation at the Northern Polytechnic, Islington. The scheme includes the supplying and installation of new generators and a completely new electrical distribution system, but it is hoped to economize in the use of electricity, particularly during the winter months, by using steam power from the heating installation to drive the generators. The estimated cost of the work is about £15,000.

Upper Boat Anniversary

Jubilee Celebrations of South Wales Station

THIS spring marked the fiftieth anniversary of the laying of the foundation stone of the Upper Boat power station by Sir Frederick Bramwell, Bart., D.C.L., LL.D., F.R.S., senior partner of Messrs. Bramwell and Harris, of Westminster, consultants to the South Wales Electric Power Distribution Co., which was formed in 1900 under one of the earliest of the Power Acts; the company deleted " Distribution " from its name in 1932.

Upper Boat was the principal generating station built by the company; there were smaller ones at Cwmbran (near Pontypool), Bridgend and Neath. The first of the latter was shut down in 1909; the other two were handed over in 1908 to the Bridgend R.D.C. and the Neath R.D.C. respectively. The Bridgend station is still in operation with much of the original plant.

The first public supply of electricity from Upper Boat was given in April, 1904. The original generating plant consisted of fourteen Niclausse boilers of 6,000 lb/hr evaporation supplying steam at 200 lb/sq in to three Willans engines, coupled to Ganz alternators each of 1,500 kW capacity, of the fly-wheel type, generating 3-phase a.c. at 25 c/s; the exciter armatures were mounted on the main shaft without an exciter bearing. It is reputed that they were the first sets in this country to generate directly at 11 kV—in 1902 the maximum for overhead lines had been specified as 500 V—and no English maker was apparently then prepared to build machines of that voltage, so the order went to the Austrian firm of Ganz at Budapest.

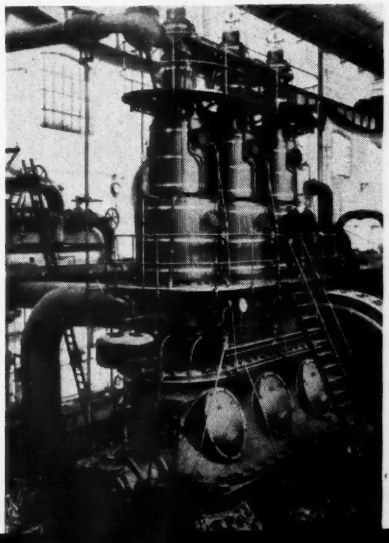
The Willans engines were unique; only four of that size were ever built and three went to Upper Boat. They were three-crank triple expansion central valve engines of some 2,500 h.p. and, as their speed was only 150 r.p.m., they were of massive construction. In 1910 the Treforest Electrical Consumers' Co., Ltd., was formed to take over the operation of the station and distribution system.

The reciprocating engines were run until 1908 when a British Westinghouse turbo-alternator of 3,000 kW was installed; two Willans-Dick Kerr sets of 3,000 and 5,000 kW were added in 1911 and 1914 respectively. Two Babcock & Wilcox boilers were installed in 1917 and two Niclausse boilers in 1921, each evaporating 30,000 lb/hr at 180 lb/sq in; the former had chain grate and the latter Erith-Riley retort stokers.

By 1938 all the above items of plant had been dismantled, but growth of demand had led in 1920 to an order for an 18,750 kW turbo-alternator from C. A. Parsons & Co. for steam at 350 lb/sq in and 750 deg F. Before that set was commissioned in 1923 Mr. J. S. Highfield—later senior partner of Messrs. Highfield & Roger Smith—was appointed as consulting engineer for further extensions. The raising of additional capital was undertaken by the South Wales Electric Power Co., Ltd., formed in 1924.

While that Parsons set was being built and installed in the old engine room the company laid down a definite policy which confirmed the higher steam pressure and temperature for future extensions. It was decided to enlarge the buildings to house eight boilers, each of 60,000 lb/hr and two

One of the original 2,500 h.p. Willans triple expansion central valve steam engines



more 18,000 kW turbo-alternators with auxiliaries. This extension was to be self-contained to enable the new plant gradually to replace the old.

When the new extensions were opened by the Rt. Hon. the Earl of Plymouth on 26th April, 1927, there was, in addition to the Parsons set in the old part of the building, a 16,000 kW English Electric turbo-alternator generating 3-phase 25 c/s a.c. at 11 kV with two auxiliary sets each of 1,000 kW. In the new boiler house there were eight Babcock & Wilcox C.T.M.-type boilers of 60,000 lb/hr at 350 lb/sq in and 750 deg F, each fitted with three chain grate stokers. In 1929 a 25,000 kW Parsons set was installed.

Transfer of Control

In 1930 financial control of the South Wales E.P. Co. was taken over by the Shropshire, Worcestershire and Staffordshire Electric Power Co., a subsidiary of Edmundsons. When additional capital was raised in 1932 these holdings were again transferred by the Shropshire Co. to the parent company, Edmundsons Electricity Corporation, Ltd.

A new problem had by then arisen—the changing of frequency—which, with 57,000 kW of plant, was no light task. The change-over was accomplished by 1937 and brought the station once more to the forefront in adopting a transmission voltage of 33 kV, and an 18,750 kW Parsons 25 c/s machine was fitted with a 50 c/s alternator generating directly at 33 kV. Later it was decided to increase to 66 kV for main transmission, and air blast switchgear was introduced. At the time of these last changes, the station superintendent was Mr. H. V. Pugh, who later became controller of the South Wales Division, B.E.A., and more recently of the London Division.

After the passing of the Electricity Supply Act, 1926, Upper Boat became a selected station and was first connected to the grid in 1934. In consequence, further extensions and alterations were made to bring the station to its present-day capacity of 155,000 kW. The station began using pulverized fuel in 1938 when a B. & W. boiler, evaporating 182,000 lb/hr at 650 lb/ sq in and 850 deg F, was installed. Two similar boilers were added in 1939 and a further one in 1940.

The first 30,000 kW set in that station was installed by the English Electric Co. in 1939, generating directly at 33 kV, and a similar set was added in 1940. The increased capacity brought to a head the problem of cooling water. While, in the earlier days, the River Taff had proved adequate, in 1940 it was necessary to erect a cooling tower of a capacity of 1,500,000 to 2,250,000 gall/hr on what is essentially a river site station.

A further 30,000 kW English Electric set was commissioned in 1942 at 11 kV with a generator transformer stepping directly up to 66 kV. In the same year two further boilers were installed: a Babcock & Wilcox p.f. boiler of 364,000 lb/hr and a Mitchell Stirling type boiler of 182,000 lb/hr with a Babcock chain grate stoker; both boilers have a pressure of 650 lb/sq in and a temperature of 850 deg F. The present station, therefore, is composed of two systems: high and low pressure sections, which are connected with two reducing valves so that steam can be supplied from the h.p. boiler house to the l.p. sets. Five of the six boilers in the h.p. section use pulverized fuel.

Most of the energy generated is transmitted for local distribution at 66, 33 and 11 kV extending to Margam (Port Talbot) in the west, Panteg and Pontypool in the east, and Hirwaun (Aberdare) and Dowlais (Merthyr) in the north; electricity is also exported to and imported from the national grid. Apart from the electricity supplied from this station, the Wales and Monmouthshire Industrial Estates, Ltd., take a steam supply at 350 lb pressure.

Reducing Grit Emission

On 1st April, 1948, the station became vested in the B.E.A. and almost immediately afterwards Mr. W. J. F. Debley was appointed station superintendent. The station employs approximately 400 persons and it has recently been undertaking special tests and investigations into the question of chimney grit emission from large boiler plant. This work has enabled design modifications to be made to improve the efficiency of the grit collecting plant, while very satisfactory p.f. sampling apparatus has been developed in collaboration with the Fuel Research Station.

A fiftieth anniversary dinner was held by the Sports and Social Club on 17th May and, apart from the existing staff, was attended by many of the old employees.

FINANCIAL SECTION

Company Notes and Stock Exchange Activities

Reports and Dividends

Reliance-Clifton Cables & Industrial Products, Ltd.—The annual meeting was held on 18th July, Mr. H. Davis presiding in the absence of Mr. A. Collins, the chairman, who was indisposed. In presenting the report and accounts, Mr. Davis said that during the latter part of 1951 and the earlier months of the present year they had the benefit of both rearmament and ordinary trade demands, and it was only recently that they had felt the effects of the cuts in production of goods for home consumption. Sales were in advance of the corresponding period of 1951 and if there was no marked deterioration in trading conditions there should be another set of satisfactory accounts for presentation to stockholders in due course. Whilst they remained fully occupied, the seller's market which the industry had enjoyed both at home and overseas was definitely at an end, with a resultant thinning of order books and a very marked increase in competition. Important development contracts for the Admiralty, Air Ministry and Department of Atomic Research were in an advanced stage and offered promise for the future. The expansion of the telephone service which had been suspended in order to aid the rearmament plans could not be much longer delayed and would provide work for which they were specially laid out.

The report of the Monopolies Commission on insulated electric wires and cables had recently been published. It concerned them directly only as regarded the smaller types of telephone wires and cables and in this matter the Commission had not found it necessary to recommend any substantial changes in the existing arrangements between the Post Office and manufacturers.

The Hackbridge & Hewittic Electric Co., Ltd.—The financial results for the year ended 31st March last were given in our issue of 11th July. In his circulated statement Mr. T. F. Lister (chairman and managing director) says that for each of the past three years he has reported a large increase in the volume of work in hand, and at the end of June this year orders on the books were nearly £1,500,000 greater than at the same date last year. This position is largely accounted for by a spectacular increase in the work in hand for the rectifier division which now amounts to three times that of a year ago, due principally to orders received from the Southern Region of British Railways for delivery over the next five years and from America and Canada for delivery in the next two years. The transformer and switchgear divisions have also shared in the increased business. Despite the demands of the defence programme, the supply of raw materials was sufficient to enable them to increase their output by about 10 per cent over the previous year. Output during the first three months of the current year has been well maintained. The operations of their Canadian subsidiary have resulted in a trading profit.

Scottish Cables, Ltd.—The annual meeting will be held on 12th August. In his circulated statement Mr. W. Fraser (governing chairman) says that the past year has again been a record one. Contracts and orders were considerably in excess of the previous year, and the value of overseas business has set up a new record. There has been a noticeable improvement in the supply of certain essential raw materials, and Mr. Fraser anticipates that this improvement is likely to be maintained during the current year. In a reference to the Monopolies Commission's report on the electric cable industry, Mr. Fraser reminds shareholders that their company is an independent concern and consequently they have not participated in any schemes of price maintenance or restrictive practices which are dealt with in the Commission's report.

Murex, Ltd., in a preliminary statement, reports consolidated profits for the year ended 30th April last, after providing £948,000 for taxation, of £659,000, as compared with £759,000 for the preceding year. It is proposed to pay a final ordinary dividend of 9 per cent (against 7½ per cent), making 15 per cent for the year (against 12½ per cent).

Electrical Components, Ltd., reports group profits for the year ended 31st March last of £141,372, as compared with £140,376 for 1950-51. Tax provisions absorb £90,987. It is proposed to pay a final dividend of 12½ per cent, maintaining the distribution for the year at 20 per cent.

Ruston & Hornsby, Ltd., report a group net profit, after deducting all charges, including £1,299,585 for taxation, of £898,301 for 1951-52, as compared with £746,975 for the preceding year. Of this £161,604 is retained in the accounts of the subsidiaries, and

the net profit of Ruston & Hornsby is £736,697 (against £651,178). General reserve receives £457,957, and it is proposed to pay an ordinary dividend for the year of 11 per cent (against 9 per cent). The balance carried forward is £247,187 (against £217,560 brought in).

Richardsons, Westgarth & Co., Ltd., report that after providing £479,470 for taxation, the net profit for the year ended 31st March last is £247,361, as compared with £240,851 for the preceding year. The dividend for the year is unchanged at 12 per cent.

The Cables Investment Trust, Ltd., reports a profit for the year to 30th June of £215,330, as compared with £196,777 for 1950-51. It is proposed to pay a final ordinary dividend of 6 per cent, making 8 per cent for the year (against 5 per cent).

The Globe Telegraph & Trust, Ltd., in a preliminary statement, reports a profit for the year to 30th June of £204,537, as compared with £170,485 for 1950-51. The balance is struck after providing £183,455 for taxation. The final ordinary dividend is 5 per cent, making 8 per cent for the year (against 7 per cent).

Siemens Brothers & Co., Ltd.—In connection with the issue of 1,225,000 ordinary shares to the ordinary stockholders, applications in respect of the rights amounted to 1,106,387 and applications were received for 498,970 excess shares. Applications up to 250 shares were allotted in full, and applications for larger amounts were considerably scaled down.

The East African Power & Lighting Co., Ltd.—The Power Securities Corporation, Ltd., announces that the issue of 1,737,777 ordinary shares to the shareholders has been oversubscribed.

New Companies

Electronic Computors, Ltd.—Registered 30th June. Capital £2,000. Manufacturers, dealers, merchants of electric, electronic, mechanical, hydraulic and pneumatic instruments and machinery, etc. Directors: A. Cutts, C. W. George and F. A. Hancox. Regd. office: 1213, Stratford Road, Hall Green, Birmingham.

W. Burns & Son (Electric), Ltd.—Registered 7th July. Capital £1,000. Electrical contractors, vendors of electrical appliances, radio and television installations, etc. Directors: W. Burns, Mrs. Ada L. Burns and Terence Burns, all of 254, South Road, Sheffield, 6.

G. Wallace & Co. (Electronics), Ltd.—Registered in Edinburgh 26th June. Capital £500. Manufacturers, importers and exporters of electrical and other instruments, etc. Directors: G. J. G. Wallace, J. Cumming and J. Narduzzo. Regd. office: 266, Paisley Road West, Glasgow, S.W.

S. Rogerson & Co., Ltd.—Registered 14th July. Capital £500. Electrical engineers, electrical installation contractors, electrical plant and maintenance engineers, manufacturers of and dealers in coils, transformers, dynamos, motors, armatures, etc. Directors: S. Rogerson and H. Butterworth. Regd. office: 4, Redfern Avenue, Sale, Ches.

Liquidations

Horace Dibben, Ltd., Upper Banister Street, Southampton, electrical factors.—The statutory meeting of creditors was held recently at Southampton, when a statement of affairs was submitted which showed liabilities amounting to £12,341, and net assets of £16,367. The present position was mainly attributed to lack of capital. The creditors resolved to confirm the voluntary liquidation of the company with Mr. N. Osborne, of Messrs. Rushton, Osborne & Co., 11 Finsbury Square, London, E.C. as liquidator. A committee of inspection was also appointed.

Leigh Electric Co., Ltd.—Final general meeting of members and a meeting of creditors on 22nd August, at 70, Victoria Road North, Southsea, Hants., to receive an account of the winding-up by Mr. O. G. Harvey, the liquidator.

Bankruptcies

L. J. Anthony, carrying on business in co-partnership with another at 6, Dolphin Lane, Boston, Lincs, under the style of Dolphin Electric Co., electrical, radio and television engineer.—Receiving order made 11th July on debtor's own petition.

R. S. Lees, 21, Gledhow Park Road, Leeds, lately carrying on business at the same address under the style of R. S. Lees & Co., as an electrical factor.—Last day for receiving proofs for dividend 30th July. Trustee, Mr. W. H. Meredith, 29, East Parade, Leeds, 1, Official Receiver.

J. Bannister, carrying on business as an electrical contractor at 2, The Wiend, Wigan, and also as a partner with his wife, Ada Bannister, in the business of ladies' hairdresser, at 122, Market Street, Hindley, near Wigan.—Last day for receiving proofs for dividend, 29th July. Trustee, Mr. A. T. Eaves, 47, Mosley Street, Manchester, 2.

S. H. Ireland and **V. Thomason,** carrying on business in co-partnership under the style of Ireland, Thomason & Co., at 61, Market Place, Malton, and also at 110, Willowgate, Pickering, Yorks., as electrical contractors and radio engineers.—First and final dividend of 4s. 10d. in the £, payable on and after 6th August, at 3 Alfred Street, Leeds, 1.

STOCKS and SHARES

RECOVERY in the gilt-edged market became almost aggressive during the course of last week, but the steam went out of it later. From the beginning of the month, War Loan had led the way in rising the best part of 2 points, no inconsiderable movement in that space of time for a Government security. The various British Electricity stocks, in company with the other long-dated issues, were well in the running, with gains of between one and two points over the same period. The 4½ per cent stock, redeemable 1974–79, recovered to the price of 99 at which it was issued last April, since when the quotation has been down to a discount of a point and more. The subsequent reaction left prices with gains on the month to date. Sobriety returned to the market after the Prime Minister's reference to very grave and far-reaching matters to be discussed before the Parliamentary summer recess. Industrial prices keep firm on the whole. Good reports serve to steady the list, despite frequent warnings from chairmen at the annual meetings.

Premiums on New Issues

New shares issued recently by way of rights to existing stockholders of some electrical and other companies, continue to capture much of the interest passing in the industrial market and the premiums on them have developed in a somewhat striking manner. Allen West & Henley's Telegraph new ordinary shares were first dealt in at the beginning of last month with a premium of about 6d on the prices at which they were offered. The Allen Wests (now fully paid) have since moved up to 2s 9d above the issue price of 8s, and on Henley's (fully-paid to-day, Friday) the premium is 1s 6d. Siemens new shares started life less than a month ago at a premium of under 1s, which has since expanded to 3s: the shares are now fully paid. On Telegraph Construction new shares, in which dealings started this month, the premium has strengthened from an initial 2s to 2s 6d.

"Rights" to New Shares

Experiences of the issues mentioned above, and of various others, suggest that some sort of routine seems to have temporarily established itself on the occasion of "rights" offers of shares for cash. First market reactions are, almost invariably, a sharp marking down of the existing shares, in anticipation of a volume of selling by holders unwilling, or unable, to subscribe to the new. Early dealings in the latter are apt to reflect the materialization of such anticipations; but the corresponding rise in prospective yields on the shares concerned, coupled with the usual freedom from stamp duty on the transfer of renounced allotment letters, helps to bring in buyers. Consequent recovery in the price tends to strengthen, after calls on the shares have been met. If any importance can be attached to the regularity with which matters have taken this course (aided by favourable market conditions) in recent weeks, the moral seems to be that intending sellers of "rights" need be in no hurry to dispose of them, and, conversely, that the best buying opportunities occur in the early stages.

Stock on Offer

A fairly substantial line of Telephone Manufacturing 5s ordinary shares has lately been on offer at a price of 8s, to yield 6¼ per cent on the basis of the 10 per cent dividends paid for each of the last three years, the last of which came from earnings equivalent to 37 per cent on the ordinary capital. Lancashire Dynamo £1 ordinary are available at a little below £2, the yield at 38s 6d being £6 9s 0d per cent. Dictograph Telephone 2s shares are available in the market at 4s 9d, which gives a prospective return of 8 guineas per cent on the 20 per cent rate of dividend. In the lists of preference shares on offer are Johnson & Phillips 4½ per cents at 17s 9d, yielding a little over 5 per cent; Thorn Electric "fives" at the same price, yielding 5·6 per cent; and Cossor "sixes" at 16s 6d, giving 7¼ per cent on the money.

Electricity Overseas

Selling of "rights" to the current issue of East African Power & Lighting 20s shares, offered to stockholders at 22s 6d, reduced the premium to about 1¼d, in advance of the first call of 7s 6d per share due last week. With this out of the way, the premium advanced to 1s. Further calls of the same amount will be made in October and December. Until then a buyer can acquire the shares free of transfer stamp, and can see a prospective return of nearly 6 per cent on the money, assuming a continuance of the long succession of 7 per cent dividends. It is some time since shares have been available on terms as good as that.

Electrical Components Results

The Electrical Components company was made public shortly before the war. After a modest start from that time, net taxed profits reached £50,000 in 1948–9 and have since been well maintained at a little over that mark. Preliminary figures now published for the year ended last March show a net surplus this time of £50,400. The dividend on the £170,800 ordinary stock is to be a total of 20 per cent for the third year running, and absorbs, with the payment on a small amount of preference capital, less than £20,000 net. Quoted officially at 10s, ex the final dividend, the 5s ordinary shares pay 10 per cent on the money.

Electrical Investments

Past Week's Price Changes

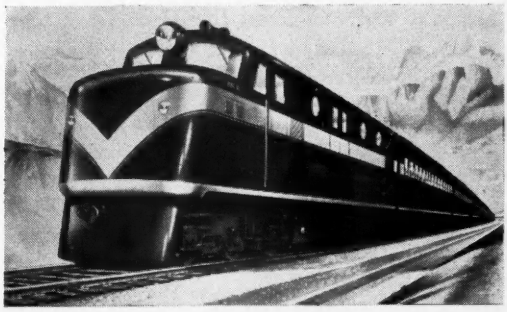
Company	Dividend Previous	Dividend Last	Middle Price July 21 1952	Week's Rise or Fall	Est. Yield p.c. £	s	d
Gilt-edged and Overseas Stocks							
Brit. Elec. 1968/73	3	3	81½	—	3	13	7
Brit. Elec. 1974/77	3	3	80	—	3	15	0
Brit. Elec. 1976/79	3½	3½	86	—	4	1	7
Brit. Elec. 1974/79	—	4½	99	+½	4	5	10
Calcutta Elec. ..	6†	6†	20/6	−3d	5	17	1†
East African Power	7	7	25/-	+6d	5	12	0
Nigerian Elec. ..	10	10	20/-	—	10	0	0
Palestine Elec. "A"	5†	5†	13/6	—	7	8	2†
Perak Hydro-Elec.	Nil	Nil	11/6	—		Nil	
Equipment and Manufacturing							
Aberdare Cables (5/-)	20	20	11/-	—	9	1	10
Aerialite (1/-) ..	83½	88½	7/3	—	12	4	0
Aron Elec. Ord. ..	15	15	32/6	—	9	4	8
Assoc. Elec. Ord. ..	20	20	69/6	—	5	15	2
Automatic Tel. & El.	15	15	55/-	—	5	9	1
Babcock & Wilcox	18	18	63/9	—	5	12	10
Baldwin, H. J. (2/-)	25	25	4/9	—	10	10	6
Bakelite (10/-) ..	—	—	17/-	+9d		—	
British Aluminium	10	12	41/3	−3d	5	16	4
B.I. Callender's ..	7½	9	30/3	—	5	19	0
British Thermostat (5/-)	30	30	24/6	—	6	2	5
British Vac. Cleaner (5/-)	25	25	12/6	—	10	0	0
Brook Motors (10/-)	20	20	28/9	—	6	19	2
Brush Ord. (5/-) ..	10	10	5/-	—	10	0	0
A. F. Bulgin (1/-) ..	27½	30	2/6	—	12	0	0
Burco (5/-) ..	42½	38¾	18/9	—	10	6	8
Chloride El. Storage	15	15	56/3	—	5	6	8
Cole, E. K. (5/-) ..	25	25*	15/-	—	8	6	8
Cossor, A. C. (5/-)	Nil	Nil	11/3	—		—	
Crabtree (10/-) ..	17½	17½	31/-	—	5	13	0
Crompton Parkinson Ord. (5/-) ..	11¼	11½	8/6	—	6	12	3
De La Rue (5/-) ..	50	35*	9/6	−6d	13	3	0*
Decca (1/-)	112½	112½	16/3	+3d	6	18	6
Dewhurst (2/-) ..	35	22½*	4/6	—		—	
Dictograph Tel. (2/-)	20	20	4/6	—	8	17	9
E.M.I. (10/-) ..	8	12	14/-	−6d	8	11	6
Electrical Components (5/-) ..	20	20	10/-xd	—	10	0	0
Elec. Construction	15	15	43/6	—	6	18	0
Enfield Cable Ord.	7½	7½	20/6	+2/6	7	6	6
English Electric ..	15	15	53/6	—	5	12	0
Ericsson Tel. (5/-)	22†	22*†	35/-	—	3	2	9†
Ever Ready (5/-) ..	35	35	23/-	+3d	7	12	2
Falk Stadelmann	15	15	35/9	—	8	7	10
G.E.C. Ord. ..	17½	22½	78/6	−1/-	5	14	8
General Cables (5/-)	30	30	12/6	—	12	0	0
Greenwood & Batley	15	15	40/-	—	7	10	0
Hackbridge Cable (5/-)	20	20	9/9	—	10	5	2
Hackbridge Hewittic (5/-)	18	20	15/-	—	6	13	4
Hall Tel. Acc. (10/-)	10	10	10/-	—	10	0	0
Heatrae (2/-) ..	12½	12½	4/-	—	6	5	0
Henleys (5/-) ..	20	20	16/-	+9d	6	5	0
Holophane (5/-) ..	15	15	10/-	—		—	
Hoover (5/-) ..	37½	35*	23/3	—	7	10	6

Company	Dividend Previous	Dividend Last	Middle Price July 21 1952	Week's Rise or Fall	Est. Yield p.c. £	s	d
Equipment and Manufacturing (continued)							
Intl. Combustion (5/-)	20	25	21/6	−3d	5	16	3
Johnson & Phillips	15	15	49/6	—	6	1	3
Lancashire Dynamo	22½	12½*	38/6	—	6	9	1
Laurence, Scott (5/-)	12½	15	11/9	—	6	7	8
London Elec. Wire	10	12½	45/-	+⅛	5	11	1
J. Lucas	17½	7½*	31/3	—	4	16	0
Marryat & S. (2/-)	22½	22½	5/-	—	9	0	0
Mather & Platt ..	12½	12½	40/6	+1/-	6	3	6
Metal Industries ..	10	15	42/6	+1/-	7	1	2
Mid. Elec. Mfg. ..	15	15	55/-	—	5	9	0
Murex	12½	15	52/-	+9d	5	15	5
Newman Ind. (2/-)	6	10	2/6	—	8	0	0
Oldham & Son (1/-)	30	30	4/3	—	7	1	3
Parnall (Yate) (5/-)	6	6	3/3	—	9	4	6
Parsons, C. A. ..	15	10*	47/6	—	4	4	3
Plessey (5/-) ..	20	22½	17/-	—	6	12	4
Pye Deferred (5/-)	35	18*	16/-	+1/-	5	12	6
Revo (10/-) ..	27½	27½	36/3xd	+⅛	7	11	9
Reyrolle	15	10*	42/-	—	4	15	3
Scot. Cable (4/-) ..	30	32	20/9	—	6	3	6
Siemens Ord. ..	10	10	31/-	+1/-	6	9	0
Strand Elec. (5/-) ..	17½	17½	8/3	—	10	12	2
Sturtevant (5/-) ..	16½†	17½*†	21/3	—		—	
Switchgear & Cowans (5/-)	22½	22½	13/9	—	8	3	8
Taylor T. (5/-) ..	20	20	20/-	—	5	0	0
T.C.C. (10/-) ..	20	20*	36/3	—		—	
T.C. & M. ..	10	10	24/-	+1/-		—	
Telephone Mfg. (5/-)	10	10	7/9	—	6	9	0
Thorn Elec. (5/-) ..	20	10*	8/6	—	5	17	8
Tube Investments	25	25	51/3	—		—	
Vactric (5/-) ..	Nil	Nil	4/6	—		Nil	
Veritys (5/-) ..	Nil	7½	3/9	—	10	0	0
Walsall Conduits (4/-)	70	70	49/6	—	5	13	3
Ward & Goldstone (5/-)	44	45*	37/6	−6d	6	0	0
Watford (2/-) ..	25	25	6/-	—	8	6	8
Westinghouse Brake	14	14	45/-	—	6	4	6
West, Allen (5/-) ..	12½	15	10/9	—	6	19	6
Trusts, Transport and Communications							
Anglo-Am. Tel.: A Ord. ..	—	4½	77½	—	5	16	2
Ord.	—	56/3	50	—	5	12	0
Anglo-Portuguese	8	8	20/6	+3d	7	16	2
Brit. Elec. Traction: Def. Ord. ..	22½	25	400	+5	6	5	0
Cable & Wireless: Ord.	6	8	110½	—	7	4	10
4% Loan ..	4	4	96	—	4	3	4
Calcutta Trams ..	6†	6†	23/6	+1/-	5	2	5†
Cape Elec. Trams	4	5	12/6	—	8	0	0
Marconi Marine ..	7½	10	28/-	—	7	2	10
Oriental Tel. Ord.	16	16	55/-	+⅛		—	
Telephone Props.	8	8	27/6xd	—	5	16	0
Tele. Rentals (5/-)	10	10	7/9	−6d	6	9	0

* After capital bonus.
† Dividends are paid free of Income Tax.

DIESEL-ELECTRIC LOCOMOTIVE

Improved Design for Narrow Gauge Railways



A 955 H.P. diesel-electric locomotive representing, in performance of a specified range of duties, the maximum achievement on a 10 ton axle load for a narrow gauge railway, has been developed jointly by Birmingham Railway Carriage & Wagon Co., Ltd., Crompton Parkinson, Ltd. and Sulzer Bros. (London), Ltd. Nineteen of these locomotives are now being built for operation in important but remote areas of Australia and West Africa.

The design achieves a combination of low weight and axle loadings with great strength, reliability and long life of the mechanical structure. Being of double bogie design it can replace, without exerting heavier stresses on tracks and bridges, steam locomotives with six or eight coupled wheels of 8 ton axle load and bridge loadings as low as Cooper E.18 standard.

As a result of the construction methods employed, strength and rigidity have been achieved together with a low overall weight without the use of light alloys. A number of special features contribute to this result; notably box structures instead of rolled sections for the main frame and body and the use of main structural members for air ducting. The main frame is welded throughout and designed to take an end buffing load of 100 tons with flexing reduced to the minimum.

The bogies are of the three-axle swing-bolster type, all welded and stress relieved. The outer axles of each bogie are motored by an axle-hung motor with plain suspension bearings. The four motors are force ventilated and also provided with fans to give added cooling while the locomotive may be coasting with the engine and blower shut down.

The main and auxiliary generators are combined in one single bearing machine and the generator set is directly coupled to the engine, the main frames of the engine being extended to support the generator, the whole forming a rigid unit. The radiator fan, the compressor, the water pump and traction motor blowers are driven by drip-proof electric motors and the auxiliaries are supplied at 110 V, lead-acid or alkaline batteries of ample capacity being supplied as alternatives. In either case the engine can be started by the battery even in a half discharged condition.

Locomotive control is by one main handle regulating engine power. Automatic load control makes it impossible for the engine to be overloaded and ensures that it runs at the lowest possible speed for a required power. The equipment is arranged so that the engine is fully protected against damage through loss of oil or water pressure, or excess water temperature, while electric overcurrent and earth fault protection are also incorporated.

Southern Consultative Council

THE Southern Electricity Consultative Council met at Poole generating station on 15th July, Mr. A. Lockwood, the chairman, presiding. On the question of increased tariffs it was reported that the Board had issued a statement indicating that the modifications suggested by the Consultative Council could not be accepted at this stage, but that all standard tariffs would be reviewed from time to time in the light of experience. The Council considered that it should be given in more detail the reasons which influenced the Board to reject its suggested modifications, and the chairman promised to consult with the Board and let the members know at the next meeting.

Several enquiries and complaints were discussed. The chairman said that he would ask the Board to hasten a supply to a rural community whose application for electricity had been outstanding since 1946. Mrs. Bosanquet (Oxford) submitted a resolution passed by the National Federation of Women's Institutes urging the Government to speed up the provision of electricity in the countryside. Mr. Lockwood said that the Minister had already allotted an extra amount of capital for this particular purpose, but that at the present moment a shortage of materials was as much a factor of delay as the lack of capital.

The next meeting of the Council is to be held at Reading on 16th September.

SOUTH AFRICAN NOTES

From Our Cape Town Correspondent

A MUNICIPAL oil-burning power station is being erected in Walvis Bay. It is designed for an ultimate capacity of 5,000 kW and will cost approximately £300,000. It will serve the municipality, six fish-canning plants, harbour installations and other industrial undertakings planned for Walvis Bay.

Work has been started on a new power station at Wilge, near Witbank, to augment the Rand system of the Electricity Supply Commission to provide more power for uranium production. An official of "Escom" said that the new power station would cost about £10,000,000 and would have a capacity of 180,000 kW. The new station would be built at a colliery pithead and the first unit would be operating next year. This station, with the Taaibos and Vierfontein stations, would complete the programme of new power station construction and is estimated to be sufficient to meet power requirements for many years.

The Cape Town City Council has confirmed agreements with the Electricity Supply Commission for the supply of electricity after 1957 and has authorized orders for urgently-needed plant for the No. 2 Salt River power station. It was said that even if the Council decided to build a new municipal power station it would still be necessary to purchase electricity from the Commission after 1957. The most optimistic estimates showed that Cape Town would require "Escom" electricity up to 1960, provided the city could get the ground and design its new power station in the very near future. It was pointed out that it required about 65 months for the delivery of the boilers alone.

Control of Unsafe Appliances

South Africa might be becoming a dumping ground for low-priced, inferior electrical goods which were being excluded by other countries, said Mr. J. W. Swardt, principal engineering technical officer of the South African Bureau of Standards, when reading a paper to the convention of the Association of Municipal Electrical Undertakings in May. More countries were adopting effective measures to control the sale of unsafe or inferior electrical goods, he said. In South Africa the matter had been discussed each year for the past few years, but so far no comprehensive set of compulsory safety specifications had been drawn up. Many accidents with electrical appliances that resulted in death, injury or fire happened because safety standards were inadequate.

The city electrical engineer of Bulawayo, Mr. A. R. Sibson, told the conference that a toy electric stove which had appeared in a Bulawayo shop just before Christmas had made the hair on the heads of his staff "literally rise." One delegate mentioned an electric travelling iron which was "a beautiful little death-trap." The conference passed a motion that the Union Minister of Economic Affairs be asked to consider promulgation of electric safety specifications under the Standards Act of 1945.

Compulsory Specification Proposed

A circular issued by the Chamber of Commerce says that the South African Bureau of Standards intends to obtain a compulsory safety specification for electrical appliances. After the specification has been promulgated it will be illegal for shopkeepers to sell appliances which do not conform to the requirements. The circular says that traders should request their suppliers to satisfy them that electrical appliances sold complied with the Bureau's safety specifications.

The use of the water power available in the Cape mountains in the winter months to generate electricity could be of great significance for the whole Western Cape electricity system according to Professor A. F. P. J. Heydorn, head of the Electrical Engineering Department of the University of Stellenbosch. He said that during 1951 the half-hourly maximum demand at the Cape Town pooled power stations was 161–200 kW in January and February, and in July it was 226,000 kW. Winter water power could provide for more than half this difference and could thus greatly relieve the position at the critical time.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 3rd September from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1945

21211/2. Revere Copper and Brass, Inc.—Electric furnaces. 20th August, 1945. (678262/3.)

27568. Philips Electrical, Ltd., and Haegele, F. G. A.—Thermal electric switches of the glow discharge type. 28th November, 1947. (678441.)

1947

17088. Speed Development Co., Ltd., and Ruffle, W. H. —Temperature change responsive means for controlling electric circuits. 26th September, 1947. (678502.)

1948

5994. Director of the Office of Technical Services, Department of Commerce.—Radio locating systems. 27th February, 1948. (678268.)

11844. Compagnie Industrielle des Téléphones.—Party-line telecommunication system. 30th April, 1948. (678503.)

18155. British Thomson-Houston Co., Ltd.—Halogenated dielectric compositions containing sulphur. 6th July, 1948. (678553.)

19999. Stoffregen, W.—Arrangement for the recording or indicating of electric signals. 27th July, 1948. (678366.)

1949

2416. Watliff Co., Ltd., and Hinchliff, A. O.—Commutators. 28th April, 1950. (678274.)

5500. Stern, W. L.—Automatic signalling or control systems. 24th February, 1950. (678369.)

6676. British Electric Resistance Co., Ltd., and Newnham, L. A.—Electric resistances. 12th June, 1950. (678511.)

7005. M-O Valve Co., Ltd., and Willshaw, W. E.—Magnetron oscillators. 14th June, 1950. (678370.)

7817. Radio-Industrie.—Methods of and apparatus for producing modulating signals in television. 22nd March, 1949. (678371.)

8458. Electric & Musical Industries, Ltd.—Cathode-ray tube apparatus. 29th March, 1950. (678372.)

15357. Electric & Musical Industries, Ltd.—Thermionic valve amplifiers. 9th June, 1950. (678615.)

15600. Electric & Musical Industries, Ltd.—Apparatus, such as television transmitting apparatus, embodying an image pick-up tube. 24th May, 1950. (678375.)

19729. Namenyi-Katz, L.—Method and apparatus for the amplification of sounds received from and of sounds transmitted to a telephone hand combination. 27th July, 1950. (678380.)

21923. Laine, R.—Assembly for electrical resistance units. 23rd August, 1949. (678516.)

23672. Pye, Ltd., and Green, J. D. F.—Suspension arrangement for cathode-ray tubes. 6th September, 1950. 678297.)

24679. Radio Corporation of America.—Means for frequency stabilization. 26th September, 1949. (678383.)

26192. West & Co., Ltd., A., Babler, E. B., and Breeze, V. L.—Joining of electrical conductors. 2nd October, 1950. (678450.)

26639. Belling & Lee, Ltd.—Electrical condensers. 2nd October, 1950. (678384.)

26772. Metropolitan-Vickers Electrical Co., Ltd.—Positional control systems. 25th August, 1950. (678385.)

26785. Electric & Musical Industries, Ltd.—Servo-mechanism. 5th October, 1950. (678520.)

30597. M-O Valve Co., Ltd., and Collins, E. J.—Diode rectifiers. 6th September, 1950. (678521.)

30791. Ges. zur Forderung der Forschung an der Eidgenossischen Technischen Hochschule.—Television apparatus. 30th November, 1949. (678307.)

31416. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Time-limiting circuits. 7th December, 1949. (678388.)

31684. English Electric Co., Ltd.—Electric welding apparatus. 8th December, 1950. (678570.)

32728. Philips Electrical, Ltd.—Ignition devices for electric discharge tubes. 21st December, 1949. (678453.)

33329. Standard Telephones & Cables, Ltd.—Radio altimeters. 29th December, 1950. (678389.)

1950

175. Ekco-Ensign Electric, Ltd., Boo, W. de, and Geisow, B. H.—Holders for tubular electric lamps. 4th January, 1951. (678314.)

542. Communications Patents, Ltd., and Kinross, R. J. —Distribution of television signals or other carrier waves by wire line. 20th March, 1951. (678391.)

656. British Insulated Callender's Cables, Ltd.—Detachable two-part electric cable couplings. 10th January, 1951. (678392.)

809. Mettoy Co., Ltd.—Electric motors. 10th April, 1951. (678620.)

933. British Vacuum Cleaner & Engineering Co., Ltd., Wright, R. D. H., and Delgado, P. E.—Synchronous electric motors. 15th December, 1950. (678526.)

2367. Radio Corporation of America.—Sine wave semiconductor oscillators. 30th January, 1950. (678317.)

2558. Electric & Musical Industries, Ltd.—Clothes-washing machines. 1st February, 1951. (678400.)

2653. Rely-a-Bell Burglar & Fire Alarm Co., Ltd.—Alarm system, more especially a burglar alarm system. 9th March, 1951. (678529.)

2829. Standard Telephones & Cables, Ltd.—Telecommunication system comprising PBX lines. 3rd February, 1950. (678319.)

6295. Automatic Telephone & Electric Co., Ltd.—Telemetering systems. 6th March, 1951. (678324.)

6339. Rotax, Ltd.—Electric motors. 7th March, 1951. (678403.)

7074. Metropolitan-Vickers Electrical Co., Ltd.—Fault protection of electric beater and similar circuits in electric vehicles. 3rd November, 1950. (678464.)

7255. Wharton Crane & Hoist Co., Ltd.—Electrically-driven winches. 22nd March, 1951. (678466.)

7616. British Thomson-Houston Co., Ltd.—Reshaping apparatus for mounts for electric discharge devices. 27th March, 1950. (678582.)

8441. Newman, J. B., and Porter, C. I.—Mechanically-released electrical switch devices. 4th April, 1951. (678631.)

8446. British Thomson-Houston Co., Ltd., Vince, N., and Taylor, H. B.—Wave-guides. 3rd April, 1951. (678632.)

8593. Soc. Francaise Radio-Electrique.—Phase modulation receivers. 5th April, 1950. (678584.)

8761. Philips Electrical Industries, Ltd.—Electric incandescent lamps. 6th April, 1950. (678635.)

13659. Standard Telephones & Cables, Ltd.—Arrangements for measuring non-linear distortion in frequency modulation communicating systems. 31st May, 1950. (678533.)

14660. Siemens & Halske Akt.-Ges.—Printing telegraph receivers. 12th June, 1950. (678411.)

17880. Thorn Electrical Industries, Ltd.—Luminescent materials. 28th February, 1951. (678596.)

19240. Staatsbedrijf der Posterijen, Telegrafie en Telefonie.—Circuit arrangement for supervising the operation of a relay armature. 1st August, 1950. (678535.)

19446. Midgley, A. H.—Operating arrangements for electric time switches. 6th December, 1950. (678536.)

20217. Erie Resistor Corporation.—Condenser. 15th August, 1950. (678334.)

20964. Fassbender, J., Moglich, F., Rompe, R., and Damzog, K.—Photo-electric devices. 24th August, 1950. (678337.)

21618. Western Electric Co., Inc.—Magnetic materials and devices. 1st September, 1950. (678339.)

21889. Thermionic Products, Ltd.—Erasing heads for electro-magnetic recording or transducing apparatus. 5th September, 1950. (678341.)

31242. Rauland Corporation.—Electron discharge tubes. 22nd December, 1950. (678546.)

1951

367. Bendix Aviation Corporation.—Frequency regulating systems for motor driven alternating current generators. 4th January, 1951. (678424.)

432. Philips Electrical Industries, Ltd.—Method of electric arc welding. 5th January, 1951. (678547.)

1836. British Thomson-Houston Co., Ltd.—Electric plug connectors. 24th January, 1951. (678498.)

2601. Westinghouse Electric International Co.—Defrosting of refrigerating apparatus. 2nd February, 1951. (678426.)

3099. Standard Telephones & Cables, Ltd.—Electrical component assemblies such as dry rectifiers and condensers. 8th February, 1951. (678353.)

5741. British Tabulating Machine Co., Ltd., Womersley, J. R., and Townsend, R.—Electronic adding devices. 9th March, 1951. (678427.)

5892. Standard Telephones & Cables, Ltd.—Method of fixing connecting strips to the electrodes of electric condensers, particularly to the electrodes of electrolytic condensers. 12th March, 1951. (678610.)

5978. Westinghouse Electric International Co.—Cooling systems for rotary electrical apparatus. 13th March, 1951. (678357.)

6119. Ateliers de Constructions Electriques de Charleroi.—Magnetic recorders with record tapes or the like of great width and/or length. 14th March, 1951. (678358.)

7431. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Method of locally removing the insulation layer of enamelled wire. 30th March, 1951. (678656.)

7695. Standard Telephones & Cables, Ltd.—Polarized electro-magnetic relays. 3rd April, 1951. (678660.)

7746. Siemens-Schuckertwerke Akt.-Ges.—Electricity meters. 3rd April, 1951. (678662.)

7920. British Thomson-Houston Co., Ltd.—Centrifugal pumps. 5th April, 1951. (678669.)

8027. Philips Electrical Industries, Ltd.—Circuit arrangements comprising a frequency-modulated oscillator with automatic frequency correction. 6th April, 1951. (678671.)

8404. British Thomson-Houston Co., Ltd.—Testing of sealed envelopes using high-frequency high voltage.—11th April, 1951. (678678.)

8758. Bosch Ges., R.—Voltage regulators for dynamo-electric machines. 16th April, 1951. (678684.)

8908. Westinghouse Electric International Co.—Single-phase induction motors. 17th April, 1951. (678685.)

8993/4. Philips Electrical Industries, Ltd.—Neutralized high-frequency push-pull amplifiers. 17th April, 1951. (678689/90.)

9052. British Thomson-Houston Co., Ltd.—Fluorescent coatings for electric lamps. 18th April, 1951. (678692.)

9189. Philco Corporation.—Input loading compensation for vacuum tube amplifiers. 19th April, 1951. (678693.)

9269. Standard Telephones & Cables, Ltd.—Ionization manometers. 20th April, 1951. (678695.)

9750. Bristol's Instrument Co., Ltd. (Bristol Co.).—Means for converting direct current to alternating current. 26th April, 1951. (678703.)

11382. Kent, Ltd., G.—Reference electrode for pH apparatus. 15th May, 1951. (678648.)

11442. British Thomson-Houston Co., Ltd.—Alternating current measuring apparatus. 16th May, 1951. (678612.)

11651. Sperry Products, Inc.—Device for use with piezo-electric crystals. 18th May, 1951. (678710.)

Amended Specification

642447. Moravian Electrical Engineering Works and another—Circuit connection for the compensation of shunt multiphase commutator machines.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 9th August:—

B.I. CALLENDER'S (design). No. 694,558, Class 9. Electric cables and insulated wires, electric wiring systems and electric cable installations for power transmission and parts of, and fittings for, such systems and installations, all included in Class 9; and electric capacitors, electricity meters and electric welding apparatus.—British Insulated Callender's Cables, Ltd., Norfolk House, Norfolk Street, London, W.C.2.

ELPREQ. No. 705,283, Class 9. Electronic instruments and apparatus, parts and fittings, all included in Class 9.—Electronic Precision Equipment, Ltd., 42–46, Windmill Hill, Ruislip Manor, Middlesex.

KING'S MESSENGER. No. 705,530, Class 9. Television apparatus and parts included in Class 9.—Avimo, Ltd., Herbert Street, Rowbarton, Taunton, Somerset, and 27 Regent Street, London, S.W.1.

CLEFA. No. 706,049, Class 9. Electrical junction boxes and parts thereof included in Class 9, electrical conductors and connectors; and buckle clips, earth clips, bonding bars and wiring saddles, all being goods of metal for use in electrical wiring installations.—Central London Engineering (Fabrications), Ltd., 115, Old Street, London, E.C.1.

"MERKLOW" (design). No. 706,664, Class 9.—Insulated connectors included in Class 9 for use in joining lengths of electric welding cable.—Archibald Low & Sons, Ltd., 82, Merkland Street, Partick, Glasgow, W.1.

COOLIE. No. 707,182, Class 11. Lighting installations, parts and fittings, all included in Class 11.—Benjamin Electric, Ltd., Brantwood Works, Brantwood Road, Tottenham, London, N.17.

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CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

India.—Bombay.—29th August. Electricity Supply and Transport Undertaking. Supply of one 8,000 kVA transformer. (C.R.E. 24787/52. Ten/4346.)*

Irish Republic. — Dublin. — 21st August. Commissioners of Public Works. Supply and installation of electrolytic hydrogen generating plant at Valentia Observatory, Co. Kerry. (See this issue.)

Kendal.—12th September. Town Council. Street lighting scheme. (See this issue.)

Keynsham.—5th August. Urban District Council. Electrical installations in 48 houses, Park Road estate. Surveyor, Council Offices

London. — Greenwich. — 3rd September. Borough Council. Street lighting equipment. (See this issue.)

New Zealand. — Auckland. — 4th August. Auckland Electric Power Board. Supply of 6.6 kV cable. (C.R.E. 24249/52. Ten/4338 and C.R.E. 24635/52. Ten/4332.)*

South Africa.—Johannesburg.—6th August. Stores Department, South African Railways. Two 400 kVA indoor type power transformers for the Walvis Bay power station. (C.R.E. 24669/52. Ten/4340.)*

Southampton.—4th August. Corporation. Electrical work in 120 flats at Itchen. (See this issue.)

Stoke-on-Trent —31st. July. Corporation. Electric lamps for six months ending 31st March, 1953. City surveyor, Town Hall.

Uruguay. — Montevideo. — 2nd September. Usinas Electricas y Telefonos del Estado. Lead covered conductors. (C.R.E. 24852/52. Ten/4342.)*

ORDERS PLACED

London.—County Council. Electrical installations in schools:—George Lansbury County Primary, Poplar.—L.S.P. Electrical Co.; Heber County Primary, Dulwich.—Honor Bros., Ltd.; Canterbury Road County Primary, Deptford.—W. M. Grant & Co.; Virginia County Primary, Bethnal Green.—Norwest Services, Ltd.; Christopher Hatton County Primary, Holborn.—Holmes & Larkinson.

Newcastle-on-Tyne. — Regional Hospital Board. Electrical work in connection with proposed alterations to the Walkergate Infectious Diseases Hospital (£974).—G. B. Carnegie & Co., Ltd.

Tynemouth.—Town Council. Electric fittings and accessories for old people's hostels at Marden (£665).—Bonham Electrical Co., Ltd.

CONTRACTS IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Bath.—Secondary modern school for boys, Rush Hill; Carpenter & Beresford-Smith, architects, 27, Queen's Square.

Berwick.—Houses (40), Prior Park; J. H. Pierce, builder, Tweedmouth.

Billingham-on-Tees.—Houses (88), Roseberry Road, for U.D.C.; Kitching & Co., architects, 21, Albert Road, Middlesbrough.

Birmingham.—Factory and offices at Watery Lane for J. Nicklin & Sons, Ltd; J. R. Davis (Builders), Ltd., 148, Leopold Street, Birmingham, 12.

Bradford.—Erection of Reevy Hill Infants' School (£35,777); Frank Robinson & Son, Ltd., Bradford.

Bromley.—Rebuilding Church of the Good Shepherd, Moorside Road; Royce, Butterfield & Roberts, architects, 6, Avery Row, W.1.

Carlisle.—Works additions for R. Hind, Ltd.; Graham & Roy, architects, 6, Paternoster Row, Carlisle.

Carshalton.—Flats (70), Barrow Hedges site; U.D.C. surveyor.

Cheadle.—Houses for R.D.C.: Well Street site (44); L. Bates, Ltd., Bycars Road, Burslem, Stoke-on-Trent. Holt Lane, Kingsley Holt (14); J. A. Bailey, Tape Street, Cheadle.

Cheltenham.—Houses (32), Knapp estate; Rainger, Rogers & Smithson, architects, 29, Radney Road.

Dagenham. — Bishopwood C.C. Primary School (£200,000); Pavitt Bros., Ltd., builders, Aveley.

Darlaston.—Houses (132), Bentley estate and aged persons' bungalows, Bush Street and Hall Street East (16); G. R. Rowlands, clerk, Town Hall.

*Specifications may be inspected at the Commercial Relations and Exports Department, Board of Trade, Horse Guards Avenue, Whitehall, S.W.1 (Trafalgar 8855).

Finchley.—Factory extensions; W. H. Perry, Ltd., Ballards Lane, N.12.

Flats (12), Vines Avenue; Howard Sharp, architect, 1285, High Road, N.20.

Flintshire. — Secondary modern school at Saltney; county architect, Mold.

Garstang.—Houses (34), School Lane, Forton; R.D.C. surveyor.

Glasgow.—Water pumping station, Drumchapel; F. A. Macdonald & Partners, consulting engineers, 11, Woodside Terrace.

Works extensions; Begg, Cousland & Co., Ltd., 636, Springfield Road.

Goole.—Flats (72), Alexandra Street; borough architect.

Great Yarmouth.—Hostel for aged persons, Caister Road; borough engineer.

Grimsby.—Offices (four-storey), Ladysmith Road; Smethurst, Ltd., fish curers.

Halifax.—Houses (102), Mixenden; borough engineer.

Hartley Wintney (Hants).—Houses (99), Manor Park, Yateley; P. Mitchell, R.D.C. surveyor.

Lancashire.—School clinics at Bacup and Little Hulton, in 1953/54 programme; county architect, Preston.

Liverpool.—Church hall at Conleach Road for Speke Methodist Church Committee; H. Thearle, architect, 66, Rodney Street, Liverpool.

London.—LAMBETH.—Dwellings (560), Upper Tulse Hill site; C. Lovett Gill, architect, 41, Russell Square, W.C.1.

Long Eaton (Notts).—Houses (100), Petersham Road estate; U.D.C. surveyor.

Lossiemouth.—Houses (42); Farrans, Ltd., builders, 42, George Street, Edinburgh.

Luton.—Houses (60), Ramridge estate, for T.C.; H. D. Carter, Ltd., builders, 3, Alexander Road, London, N.19.

Macclesfield. — Houses (26) for R.D.C.; Barker Bros., Ltd., Chester Road, Macclesfield.

Malvern. — Houses (48), Worcester Road, Malvern Link; J. Bulman, clerk, Council House.

Margate.—Flats (36), Upper High Street; borough engineer.

Nantwich.—Houses (48) at Wistaston Green for U.D.C.; Whitchurch (Salop) Contractors, Ltd., Castle Hill, Whitchurch, Salop.

Newbury.—Proposed new hospital on 11-acre site at Speen Hill; Oxford Regional Hospital Board, 43, Banbury Road, Oxford.

Newcastle-under-Lyme. — Houses (100), Earls Drive estate; Madew & Wardle, Central Works, Market Lane. Houses (33), Langdale Road; A. Jones, Ltd., London Road, Chesterton.

Newton Abbot.—Houses (61), and 10 old people's bungalows, Buckland estate; C. Lunn, surveyor, 18, Devon Square.

Peterborough.—Houses (licences granted): Clifford Jellings, Ltd. (12), H. R. Taylor (3), B. Stokeley (14) and Granville Building Co., Ltd. (4), all of Peterborough.

Houses (50), Dogsthorpe North estate; Charles W. Shelton, Ltd., 30, Westwood Park Road.

Portland.—Houses (106), Verne Common; Reema Construction, Ltd., Milford Manor, Salisbury.

Reading. — Laboratories at the N.A.A.S., Chiltern Court; W. A. James & Son, Ltd., builders, Station Works, Maidenhead.

Richmond (Yorks).—Flats (8) at Burgate and houses (44) at Gilling Road; borough engineer.

Romford.—Houses (174), Heaton Grange; J. Twinn, town clerk, Town Hall.

Sedgley.—Houses, Stickley Lane and Monument Lane sites, for U.D.C.; A. Young, architect, 3, Newhall Street, Birmingham.

Shipley.—Houses (148), Owlet Hall estate; U.D.C. surveyor.

Shotley Bridge.—Extensions to hospital; Cackett, Burns Dick & McKellar, 21, Ellison Place, Newcastle.

Smethwick.—Infants' school at rear of The Oval; borough engineer.

South Shields.—Factory additions, Bede estate, for Thermotank, Ltd.; Cackett, Burns Dick & McKellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Nurses' training school; S. W. Milburn & Partners, 9, The Esplanade, Sunderland.

Staffordshire.—Comprehensive schools at Rosehill, Willenhall and Tettenhall, near Wolverhampton; county architect, County Buildings, Martin Street, Stafford.

Stokesley.—Houses for R.D.C. Builders: Tarran & Son, Hutton Rudby (22 houses), Duncanson & Son, Ltd., Middlesbrough (30) and Spence Brothers, Newby, Middlesbrough (18).

Sunbury.—First section of modern school, Beechwood Avenue (£142,479) for Middlesex E.C.; J. Lawson & Co., contractors, Park Road North, Acton.

Tynemouth.—Thirty blocks of "Ubicon" type houses at Chirton Grange (£230,790); Leslie & Co., builders, Woodland Road, Darlington.

Wakefield. — Three-storey admission hospital, two nurses' hostels, etc., Stanley Royd Hospital (further stages at a later date); W. Shee, secretary to Leeds Regional Hospital Board, Park Parade, Harrogate.

Walton-on-Thames.—Flats (36), Cottimore Lane; W. H. Harris, clerk to U.D.C., Council Offices.

West Bromwich.—New works on eight-acre site on Lyttleton Hall estate; George Salter & Co., Ltd., manufacturers of weighing machines, etc., High Street.

Whitby.—Houses (23), The Mount, for U.D.C.; Moliekin Brothers, builders, West Parade Road, Scarborough.

Whitley Bay.—Houses (28) at Seaton Sluice; E. Roberts, U.D.C. surveyor.

Wigan. — Showrooms, Wallgate, for Joan Barry, Ltd.; Hawthorne Building & Construction Co., Ltd., Vulcan Street, Bootle.

Wigston.—Further 39 houses to be built at once and 54 later; U.D.C. architect, Wigston, Leics.